Department for Environment Food & Rural Affairs

Marine Strategy Part Two:

UK updated monitoring programmes

25 August 2020

Llywodraeth Cymru
Welsh Government

Department of Agriculture, Environment and Rural Affairs
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Contents

Advice for readers

Topic of this consultation

The UK Marine Strategy Regulations 2010 require the UK to take the necessary measures to achieve or maintain Good Environmental Status (GES) by 2020 through the development of a UK Marine Strategy. This consultation sets out our proposals for updating the UK Marine Strategy Part Two, published in 2014. It shows the monitoring programmes the UK intends to use to assess progress towards the achievement of GES for UK seas over the next 6 years.

Scope of this consultation

This consultation covers the updated UK Marine Strategy Part Two only, not Parts One or Three.

Geographical scope

The proposals apply to the marine waters over which the UK claims jurisdiction, including territorial waters in Scotland, Wales and Northern Ireland. The monitoring programme for British Gibraltar Territorial Waters is being prepared separately.

Relevance to

This consultation has particular relevance to:

- groups or individuals who use the sea for whatever purpose, or have an interest in it;
- business users of the sea and those businesses that have an impact on the sea;
- national and local interest groups such as environmental and recreational non-governmental organisations and industry federations;
- the OSPAR Commission and its contracting parties; and
- academic institutions who carry out marine monitoring and/or research

Body responsible for the consultation

This consultation is being carried out by the Marine Strategy Regulations Implementation team in Defra's Marine and Fisheries Directorate on behalf of the UK government and the Devolved Administrations.

Duration

The consultation runs for 12 weeks:

Starts 25 August 2020 and ends on 17 November 2020.

Enquiries

During the consultation, if you have any enquiries or wish to receive hard copies of the documents, please contact: marine.strategy@defra.gov.uk

Further information on the implementation of the Marine Strategy Regulations can be found in the UK Marine Strategies Part One, Part Two and Part Three which are all published on gov.uk:

https://www.gov.uk/government/publications/marine-strategy-part-one-uk-updated-assessment-and-good-environmental-status

https://www.gov.uk/government/publications/marine-strategy-part-two-uk-marine-monitoring-programmes

https://www.gov.uk/government/publications/marine-strategy-part-three-uk-programme-of-measures

We are not seeking comments on the assessment of UK seas and targets set out in the updated UK Marine Strategy Part One or the programme of measures set out in the UK Marine Strategy Part Three.

Consultation questions

Particular questions which we invite those responding to the consultation to address are set out below.

How to respond

Written responses can be submitted online via the citizen space consultation hub at Defra https://consult.defra.gov.uk/

Or sent to

Email: marine.strategy@defra.gov.uk

Post: Marine Strategy team
4th Floor Nobel House
17 Smith Square,
Westminster,
London SW1P 3JR

Responses must be submitted by 17 November 2020.

After the consultation

At the end of the consultation period we will summarise the responses and place this summary on gov.uk.

Copies of responses will be made available to the public on request. If you do not want your response – including your name, contact details and any other personal information – to be publicly available, please say so clearly in writing when you send your response to the consultation. Please note, if your computer automatically includes a confidentiality disclaimer, this will not count as a confidentiality request.

Compliance with Consultation Principles

This consultation is in line with the government's Consultation Principles. These can be found at www.gov.uk/government/publications/consultation-principles-guidance.

Consultation questions

This consultation seeks views on the monitoring programmes proposed for gathering the data to assess indicators of the status of UK seas up to 2024. Set out below are four questions on the updated UK Marine Strategy Part Two. When answering these questions please take into account the fact that addressing the issues and opportunities identified for each descriptor is subject to working in partnership with others with knowledge and expertise in the respective areas including parties external to government.

1) Are the proposed monitoring programmes sufficient to meet the requirements of the Marine Strategy Regulations 2010, bearing in mind our current knowledge base?

2) Are the proposed monitoring programmes sufficient to provide the necessary data to assess progress towards the achievement of GES, and the related targets, as set out in the updated UK Marine Strategy Part One?

3) Are any additional monitoring programmes needed in order to assess progress

towards achieving GES and the related targets?

4) Are you aware of any additional marine monitoring currently being carried out that we have not covered which could contribute to our assessments and make them more effective?

We are not inviting comments in this consultation on "the environmental status in 2018", the "high level objectives for GES", the "targets" or the "operational targets" set out in Section 2. These have been included to provide context and the rationale for the proposed monitoring programmes.

Introduction

The UK Marine Strategy, made up of Parts One, Two and Three (the Strategy) sets out a comprehensive framework for assessing, monitoring and taking action across our seas to achieve the UK's shared vision for clean, healthy, safe, productive and biologically diverse seas.

In October 2019, we published the updated Marine Strategy Part One, which laid the foundations for the second implementation cycle of the Strategy, and showed the progress made towards our vision, what targets and indicators we would be using, and what further action was necessary.

This consultation document for the updated UK Marine Strategy Part Two sets out the monitoring programmes that we propose be used to provide the evidence to be used in the 2024 assessment of progress towards achieving Good Environmental Status (GES) within the Marine Strategy area.

This requirement to monitor and assess the state of the UK seas is enshrined in UK legislation and demonstrates the combined commitments of the four UK Administrations to work together to monitor and protect what are some of the most biologically diverse and productive seas in Europe.

We will also continue to collaborate internationally with those countries that share our seas, particularly through OSPAR, our regional seas convention, to protect and conserve the marine environment of the North-East Atlantic.

Section 1: Context

1.1 The UK Marine Strategy

The Marine Strategy Regulations 2010 require us to take action to achieve or maintain GES in our seas by 2020. The Regulations require the production of a "Marine Strategy" for all UK waters and that the approach is coordinated across all four UK Administrations. It also requires that we cooperate with other countries sharing our seas. The objective of the UK Marine Strategy reflects the UK's vision for 'clean, healthy, safe, productive and biologically diverse ocean and seas'. It helps to deliver key international obligations and commitments to protect and preserve the marine environment under the UN Convention on the Law of the Sea (UNCLOS), the UN Sustainable Development Goal 14 (to conserve and sustainably use the ocean, seas and marine resources for sustainable development), the OSPAR North-East Atlantic Environment Strategy and the Convention on Biological Diversity.

The Strategy applies an ecosystem-based approach to the management of human activities. In doing so, it seeks to keep the collective pressure of human activities within levels compatible with the achievement of GES. Achieving GES will maintain the capacity of marine ecosystems to respond to human-induced changes and enable the sustainable use of marine goods and services by present and future generations.

The Strategy has three components:

a. UK Marine Strategy Part One[1]: an assessment of marine waters, sets out objectives for GES and targets and indicators to measure progress towards GES (published December 2012, updated October 2019);

b. UK Marine Strategy Part Two[2]: sets out the monitoring programmes to monitor progress against the targets and indicators (published August 2014); and

c. UK Marine Strategy Part Three[3]: sets out a programme of measures and actions for achieving GES (published December 2015).

This updated Marine Strategy Part Two sets out the monitoring programmes we propose to use to collect the required data to assess the indicators set out in the updated UK Marine Strategy Part One, which we use to assess progress towards GES.

1.2 Good Environmental Status (GES)

Good Environmental Status (GES) is defined as the environmental status of marine waters where they constitute ecologically diverse and dynamic ocean 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

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69632/pb13860-marine-strategy-part1-20121220.pdf and

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/841246/marine-strategy-part1-october19.pdf

[2] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/341146/msfd-part-2-final.pdf

[3] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/486623/marine-strategy-part3-programme-of-measures.pdf

safeguarding the potential for uses and activities by current and future generations.

To help assess progress towards GES, it is broken down into 11 qualitative descriptors:

- D1 - Biological diversity (cetaceans, seals, birds, fish, pelagic habitats and benthic habitats);
- D2 - Non-indigenous species;
- D3 - Commercially-exploited fish and shellfish;
- D4 - Food webs (cetaceans, seals, birds, fish and pelagic habitats);
- D5 – Eutrophication;
- D6 - Sea-floor integrity (benthic habitats);
- D7 - Hydrographical conditions[4];
- D8 – Contaminants;
- D9 - Contaminants in fish and other seafood for human consumption;
- D10 - Marine litter; and
- D11 - Introduction of energy, including underwater noise.

The recently updated UK Marine Strategy Part One showed we have made progress towards achieving GES. The findings of 60 different indicator assessments have enabled us not only to assess the extent to which GES has been achieved and highlight particular initiatives which have been taken to expedite progress. It has also helped to identify gaps in our knowledge and identify next steps. While we have largely achieved GES in some areas, for example eutrophication and contaminants, further work is needed in other areas, including to understand and protect bird populations, and to tackle marine litter. Full findings are available in the updated UK Marine Strategy Part One, published in 2019.

We intend to update the UK Marine Strategy Part Three in 2021 to set out the full suite of measures we plan to take to ensure that we continue to make progress

[4] No specific monitoring programme has been put forward for Descriptor 7, See Section 3 for further details.

towards GES for UK seas. For example, to help address the current declines in some UK seabird species we are preparing a comprehensive Seabird Conservation Strategy. Through national resource and waste strategies, we are reducing litter by reducing, reusing and recycling associated materials. A minimum 5p plastic bag charge is in place across the UK and a ban on microbeads in rinse-off personal care products is now in force, helping to tackle the issue of microplastics in the marine environment. The forthcoming updated UK Marine Strategy Part Three will review the effectiveness of measures to date and present additional measures we propose we need to achieve GES for UK seas.

It is clear that climate-related changes, such as rising temperature, will produce changes in ecosystem dynamics and pressures on our seas. For example, shifts are anticipated in oxygen status, prevalence of non-native species and contaminant concentrations. We have expanded on this in Section 1.9 of this document and, where we anticipate climate effects, we have included this in the 'issues and opportunities' sections.

1.3 Our approach

We will continue to collaborate at a UK, regional (OSPAR) and international level. We will take into account the extent that we have achieved GES, with effort and resources being focused on monitoring programmes for those descriptors and ecosystem components where there is low confidence on whether GES has been achieved.

The purpose of the monitoring programmes is to provide sufficient evidence to demonstrate the extent that the revised objectives and targets set out in the updated Marine Strategy Part One have been met so we can provide a robust assessment of progress towards achieving GES in 2024 within the Marine Strategy area.

Most of the proposed monitoring programmes are a continuation of existing programmes and often fulfil other policy purposes, for example Domestic Fisheries Policy. Some of these programmes have been refined or extended to address knowledge gaps identified in the first cycle so that we have more robust evidence to evaluate whether GES has been achieved. We have also identified a number of issues and opportunities to improve our monitoring and we will seek to work with others to progress these ideas to improve future assessments of GES.

A key aim for the updated UK Marine Strategy Part Two is to coordinate our actions with other countries, particularly for OSPAR Region II (the Greater North Sea) and OSPAR Region III (the Celtic Seas). We will continue to do this through the OSPAR Convention using common indicators, jointly agreed assessments and

monitoring methodologies, and through developing new indicators where necessary.

In developing the updated monitoring programmes, we also took account of the recommendations in the European Commission's evaluation of UK Marine Strategy Part Two in 2017[5].

The UK Marine Strategy is being implemented in a coordinated way across the UK Administrations. The UK monitoring programmes have been developed with input from experts and policy-makers across the UK Administrations at a scale appropriate for the particular descriptor or ecosystem component. Gibraltar has a separate implementation process and is developing a monitoring programme for British Gibraltar Territorial Waters.

1.4 Geographic scope of monitoring programmes

The UK Marine Strategy covers the extent of the marine waters over which the UK exercises jurisdiction. This area extends from the landward boundary of coastal waters, which is equivalent to Mean High Water Springs to the outer limit of the UK Exclusive Economic Zone (EEZ). It also includes the seabed in the area of the continental shelf beyond the EEZ over which the UK exercises jurisdiction on the basis of a submission to the Commission on the limits of the continental shelf[6]. The area of UK waters over which the UK Marine Strategy applies is shown below in Figure 1, which also shows the Celtic Seas (pale blue colour) and the Greater North Sea (dark blue colour) Sub-regions on which many of our assessments are based.

[5] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52017SC0001&from=EN

[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.

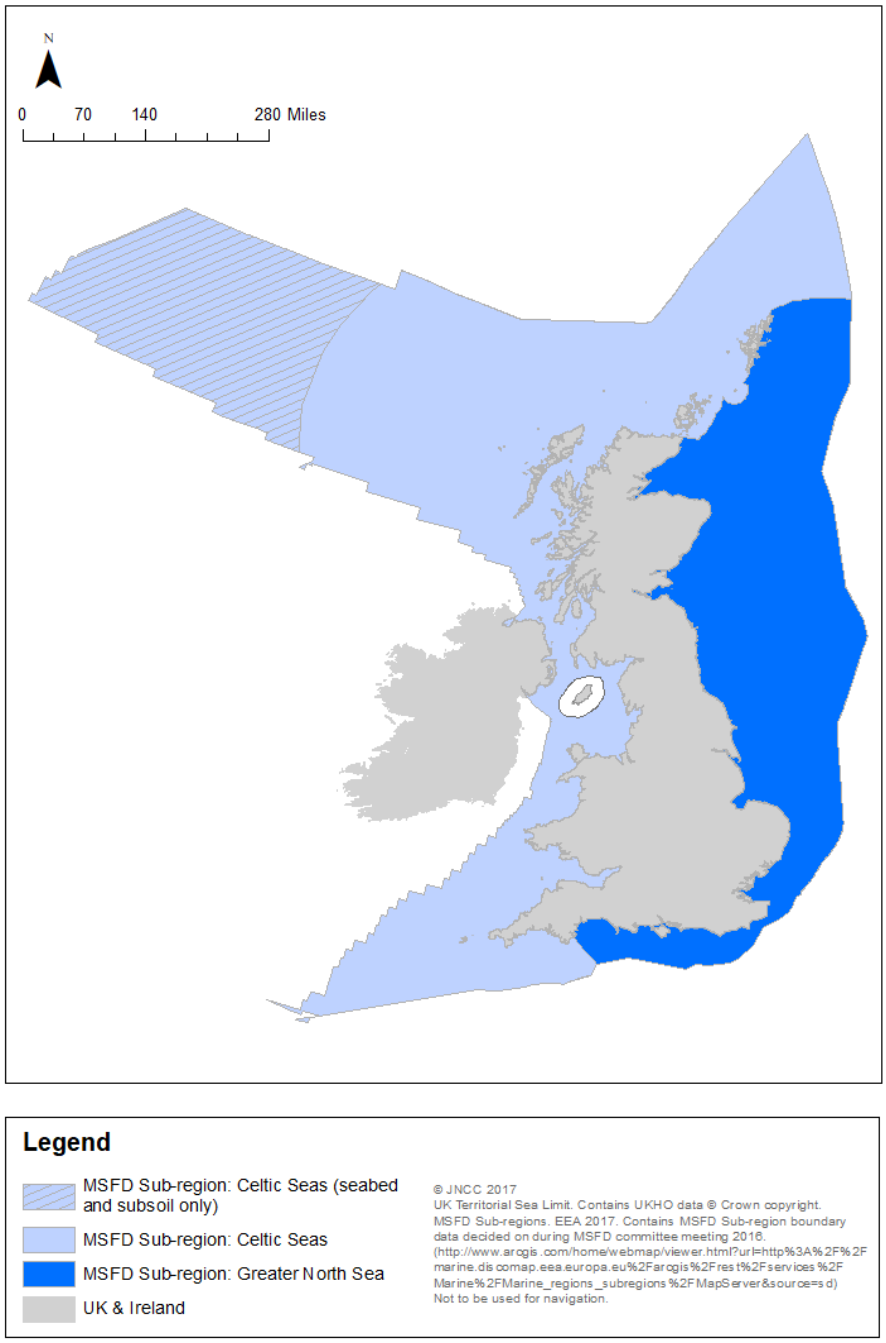


Figure 1: Area of UK marine waters where the UK Marine Strategy applies.

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 Sub-region, and waters to the east of the UK, including the Channel, forming part of the Greater North Sea Sub-region. The UK shares the Celtic Seas Sub-region with Ireland and France, and the Greater North Sea Sub-region with France, Belgium, the Netherlands, Germany, Denmark, Sweden and Norway.

The ecosystems of the Greater North Sea and the Celtic Seas and their various uses are not necessarily contained within the boundaries of the UK. Similarly, some of the habitats and species, particularly some of the mobile species, can exist over wide areas of the North East Atlantic. For this reason, it is important to develop and coordinate monitoring programmes with other countries in the OSPAR Convention.

Furthermore, there are significant biogeographical differences between the Greater North Sea and the Celtic Seas Sub-regions which need to be taken into account. Monitoring programmes have therefore been developed at the scale most relevant to the particular descriptor or ecosystem component. This can be at sub-regional scale or smaller areas where appropriate.

There are also strong links between the UK Marine Strategy and the River Basin Management Plans (RBMPs). The RBMPs address the improvement and protection of the chemical and ecological status of surface waters over the whole river basin ranging from rivers, lakes and groundwaters through to estuaries and coastal waters out to one nautical mile at sea (three nautical miles in Scotland and out to 12 nautical miles for chemical status) and overlap with the UK Marine Strategy in coastal waters.

In order to improve consistency between the approaches for coastal waters and offshore waters, the monitoring programmes in this updated Marine Strategy Part Two have been aligned with those used for coastal waters under RBMPs where appropriate.

1.5 Coordination of monitoring programmes across the UK

The monitoring programmes have been developed with the Devolved Administrations, other government departments and with scientists in the UK Marine Monitoring and Assessment Strategy (UKMMAS) evidence groups.

In developing the monitoring programmes, wherever possible we use existing monitoring programmes established to support other policies such as the Bern Convention, River Basin Management Plans, domestic fisheries legislation and for the OSPAR Convention for the Protection of the North East Atlantic.

1.5.1 The framework used for monitoring the marine environment in the UK

The scientists working in the four evidence groups of the UKMMAS[7] develop and carry out the monitoring programmes required to assess the status of UK seas, ensuring that the methodologies are up to date. The evidence groups are overseen by a science/policy committee called the Marine Assessment and Reporting Group (MARG). 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 the UK and Devolved Administration Departments with interests in the marine environment, the environment agencies, nature conservation agencies, marine laboratories, representatives from marine institutes and the research community.

The UKMMAS evidence groups and MARG have contributed significantly to the development of the updated Marine Strategy Part Two. The evidence groups ensure that the monitoring programmes are carried out at the relevant scale by laboratories operating within appropriate quality assurance systems, and where available, using internationally agreed methods and standards. Where appropriate the monitoring programmes are checked by statisticians to ensure that they are statistically robust and able to detect meaningful levels of change.

1.6 Progress with UK Monitoring Programmes

Since the UK Marine Strategy Part Two was published in 2014, there have been a number of developments.

1.6.1 Collaboration with other countries

In 2014, we took a policy decision to base most of our monitoring programmes around the OSPAR common indicators that were being developed in order to carry out a comprehensive assessment of the state of the North East Atlantic in 2017 (the Intermediate Assessment 2017 https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/). The IA 2017 provided an opportunity to see how the monitoring programmes worked in practice and how they could be improved in the future. Further detail is provided in the 'regional cooperation' section of the tables in Section 2 of this document.

[7] Clean and Safe Seas Evidence Group (CSSEG), Healthy and Biologically Diverse Seas Evidence Group (HBDSEG), Productive Seas Evidence Group (PSEG) and the Ocean Processes Evidence Group (OPEG)

1.6.2 Developments in monitoring programmes since 2014

In the UK Marine Strategy Part Two in 2014, we identified a number of gaps in our monitoring. Below, we set out the main activities we have undertaken to address those gaps since 2014:

- Research to identify what additional monitoring is needed;
- Working with other countries to develop methodologies and standards;
- National workshops to address monitoring gaps; and
- Extending surveys to provide better temporal or spatial coverage

In addition, in Section 2 we provide further, specific details of developments in monitoring programmes since 2014 for each descriptor and ecosystem component.

1.6.3 Issues and opportunities

The updated Marine Strategy Part One, published in 2019, identified a number of existing or new gaps in our monitoring programmes, and these are noted in the 'issues and opportunities' sections in Section 2. The updated Marine Strategy Part One also identified opportunities to work with industry and stakeholders to incorporate currently untapped data sources into our monitoring programmes. For example, we might incorporate industry data into our assessments or make better use of citizen science data. These opportunities are also flagged in the 'issues and opportunities' sections in Section 2.

1.6.4 How monitoring programmes address ecosystem elements and pressures

The Marine Strategy Regulations 2010 require that the monitoring programmes address certain indicative ecosystem elements and pressures on the marine environment. These include:

- species, habitats and ecosystems that need to be considered if they are essential features and characteristics in UK seas;
- pressures and impacts which significantly affect marine species and habitats; and
- uses and activities which may affect the marine environment.

The indicative ecosystem elements and pressures are generally covered in the relevant tables in Section 2. However, turtles are not regarded as a 'key trophic group' in UK waters, and we are still developing survey techniques for cephalopods (squid), so these are not covered. Furthermore, the input of microbial pathogens, genetically modified species, water, and other forms of

energy are not considered to be predominant pressures and monitoring programmes for these have not been developed.

1.7 Detailed information about monitoring programmes

Summaries of the monitoring programmes for the 60 indicators we are using over the coming years are set out in Section 2.

Many of the indicators used in the UK Marine Strategy are OSPAR Common Indicators. For each of these, detailed information on the monitoring programmes used to assess the indicators is available on the OSPAR website (https://www.ospar.org/work-areas/cross-cutting-issues/cemp).

1.8 Addressing issues and opportunities

The updated UK Marine Strategy Part One identified a number of existing or new gaps in our monitoring programmes. In many cases, further work is required to design monitoring programmes that would address those gaps before they can be implemented. For example, further research and development may be required to scope and design a robust and effective monitoring programme. These are described in the 'issues and opportunities' section for the descriptors and ecosystem components in Section 2 of this document.

We are aiming to address as many of the issues and opportunities as possible through this cycle of the Strategy, and seek to work with others with knowledge and expertise in the respective areas in order to do so.

We will also seek to work with industry and stakeholders to incorporate currently untapped data sources into our monitoring programmes. These opportunities are flagged in the 'issues and opportunities' section of the tables in Section 2.

1.9 Monitoring programmes we propose to use to address the impacts of climate change

In Section 2.7 of the recently published Marine Strategy Part One 2019, we set out an assessment of the spatial and temporal variation of ocean acidification, temperature, salinity, turbidity and waves. In addition, we provided a projection of how these variables are likely to be affected by climate change and the likely impacts on marine ecosystems. In Section 3 of this document, we set out the monitoring programmes that we propose to use to provide a further assessment in 2024 of how these variables, and associated impacts, are changing.

We also have a specific indicator (MarClim) described in the D1D6 benthic habitats table in Section 2 of this document, which assesses the response of rocky shore communities to climate change pressures.

It is likely that the impacts of climate change will have an influence on the Marine Strategy indicators used to assess the marine environment. For example, changes in waves may affect the sources and behaviours of pollutants and litter, changes in sea surface temperature may affect the distribution range of species of fish and marine birds, and changes in turbidity may affect the distribution range of habitats. We intend to work with other OSPAR countries to develop indicators that will help us monitor and better understand changes in the marine environment resulting from climate change. Where possible, we also intend to better integrate climate variability into our Marine Strategy indicators so that we can assess the specific implications of climate change and develop appropriate measures if this proves necessary.

Section 2: Monitoring programmes used to assess Good Environmental Status (GES)

For each descriptor and ecosystem component this section sets out:

- a summary of the monitoring programme;
- the status of the descriptor or ecosystem component in 2018;
- the relevent high level objective;
- the targets, indicators and monitoring programmes used to measure progress towards GES;
- a detailed description of the individual monitoring programmes;
- the degree of coordination with other countries;
- developments in the monitoring programmes since 2014; and
- any issues and opportunities going forwards.

We are not inviting comments in this consultation on the "environmental status in 2018", the "high level objectives for GES", the "targets" or the "operational targets" set out in the descriptor and ecosystem component tables set out below. These have been included to provide context and as the rationale for the proposed monitoring programmes.

The monitoring programmes presented in the templates are adaptive in nature. For example, if concentrations of a contaminant are found to be regularly below detection limits, the frequency or coverage of monitoring may be reduced, or if new problems are revealed in a particular area, then frequency or coverage of monitoring may be increased.

In some cases, the operational monitoring programmes have remained unchanged since 2014, which will be reflected in a lack of information in the 'developments in monitoring since 2014' section of the monitoring tables set out below, but should not be considered a weakness. A consistent monitoring programme is a strength because it builds a time series of comparable data, which can provide more information about trends through time and gives us more confidence in our assessments.

In other cases, more monitoring is required to make a robust assessment of the status of an ecosystem component or pressure in the marine environment, and we identify these in the 'issues and opportunities' section of the monitoring tables set out below.

<table>
<tr><th colspan="4">CETACEANS D1 D4</th></tr>
<tr><td>Overall summary</td><td colspan="3">We propose that the monitoring of cetaceans will be carried out largely by existing programmes.

Data on abundance and distribution of cetaceans are collected by the following programmes:
(i) Small Cetaceans in European Atlantic waters and the North Sea (SCANS) surveys
(ii) Bottlenose dolphin inshore population monitoring
(iii) Regional acoustic detection programmes

Mortality of cetaceans caused by fishing bycatch is monitored by:
(iv) UK Bycatch Monitoring Programme
(v) Marine Animals Stranding Schemes</td></tr>
<tr><td>Environmental Status in 2018</td><td>  </td><td colspan="2">The extent to which Good Environmental Status (GES) had been achieved for cetaceans remained uncertain. The status of coastal bottlenose dolphin and minke whale was consistent with the achievement of GES in the Greater North Sea, but unknown/uncertain elsewhere. It was unknown if GES had been achieved for other species.</td></tr>
<tr><td>High level objective for GES</td><td colspan="3">The population abundance of cetaceans indicates healthy populations that are not significantly affected by human activities.</td></tr>
<tr><td colspan="4">How progress towards GES is measured using monitoring, indicators and targets.</td></tr>
<tr><td>Criteria</td><td>Target</td><td>Indicators</td><td>Monitoring programmes</td></tr>
<tr><td>Population abundance</td><td>There should be no significant decrease in abundance caused</td><td>Abundance and distribution of coastal bottlenose</td><td>SCANS Surveys</td></tr>
</table>

	by human activities.	dolphins (OSPAR); and Abundance and distribution of cetaceans other than coastal bottlenose dolphins (OSPAR)	Bottlenose dolphin inshore population monitoring
Population distribution	Population ranges are not significantly lower than favourable reference values for the species.		Regional acoustic detection programmes
Bycatch mortality	The long-term viability of cetacean populations is not threatened by incidental bycatch.	Cetacean bycatch (OSPAR)	UK Bycatch Monitoring Programme UK Cetacean Strandings Investigation Programme (CSIP) Scottish Marine Animal Strandings Scheme (SMASS) Department of Agriculture, Environment and Rural Affairs (DAERA) marine mammal animal stranding investigations (Northern Ireland)
Operational targets	We will continue existing monitoring of cetacean bycatch in fisheries under the UK Bycatch Monitoring Programme. We will also continue the use of mitigation measures, for example acoustic deterrents ('pingers') to reduce bycatch, as well as supporting further work into novel approaches.		

	We will continue initiatives such as the SCANS survey and the Collaborative Oceanography and Monitoring for Protected Species (COMPASS)[8] project to help build a picture of how cetaceans use an area of sea. This will assist our understanding of how they may be affected by or respond to pressure from human activities, such as underwater noise.
Monitoring programme details	
Small Cetaceans in European Atlantic waters and the North Sea (SCANS) surveys	SCANS is a multilateral (ship and aerial) survey conducted approximately once every ten years in northern European waters to assess cetacean abundance. SCANS was initiated in 1994 and continued in 2005 (SCANS-II) and 2007 Cetacean Offshore Distribution and Abundance in the European Atlantic (CODA) project, with the most recent survey taking place in 2016 (SCANS-III).
Bottlenose dolphin inshore population monitoring	Inshore bottlenose dolphin populations in Special Areas of Conservation (SACs) are monitored by existing schemes on the east coast of Scotland and in the wider Cardigan Bay area, Wales.
Regional acoustic detection programmes	There are a number of programmes in place at present which aim to establish data on marine acoustics. The COMPASS project helps to build an understanding of how cetaceans use an area of sea and how they may be impacted by or respond to pressure from human activities. This information is also used to inform marine protected area management. Through a network of oceanographic and acoustic moorings across the regional seas of the Republic of Ireland, Northern Ireland and West Scotland, COMPASS provides effective cross-border monitoring of cetaceans. The project will complete in December 2022. The East Coast Marine Mammal Acoustic Study (ECOMMAS) monitors dolphin and harbour porpoise populations. Run by Marine Scotland since 2013, ECOMMAS uses echolocation click detectors at 30 sites on the east coast of Scotland, and broadband sound

[8] The Collaborative Oceanography and Monitoring for Protected Areas and Species (COMPASS), SeaMonitor and the Marine Protected Area Management and Monitoring (MarPAMM) projects are funded by INTERREG Va. These programmes will cease operationally in 2021 with no identified successor.

	recorders at ten of these sites, to acoustically detect and monitor cetaceans. In Northern Ireland moored acoustic deployments are also used as part of ongoing monitoring and the COMPASS and Marine Protected Areas Management and Monitoring (MARPAMM)[9] programmes. The data generated by COMPASS, ECOMMAS and the Agri-Food and Biosciences Institute (AFBI) will contribute distribution information to the indicator on cetacean abundance and distribution but will not provide quantitative data on abundance of cetaceans.
UK Bycatch Monitoring Programme	The UK Bycatch Monitoring Programme undertakes dedicated observations of incidental bycatch of protected species by commercial fishing vessels.
UK Cetacean Strandings Investigation Programme (CSIP)	The CSIP conducts post-mortems on cetaceans stranded on the UK coastline. In addition, data from post-mortems the Department of Agriculture, Environment and Rural Affairs (DAERA) undertake on cetaceans that strand on the Northern Ireland coast and work conducted under the SMASS are fed into CSIP. The results from the post-mortems help to identify the major causes of death, and can provide information on disease, contaminants, fisheries bycatch, reproductive patterns and diet.
Regional Cooperation	
There has been a concerted effort to coordinate UK monitoring programmes with those of other countries sharing the North East Atlantic to ensure, where possible, that the assessments carried out are comparable. Work in OSPAR focuses on the harmonisation of targets and indicators, potential measures, monitoring programmes and areas for further research.	
Developments in monitoring since 2014	
The most recent SCANS-III survey took place in July 2016; the preliminary results have been published online and the data were used in the indicators listed above for the OSPAR Intermediate Assessment 2017 and the assessments used for the updated Marine Strategy Part One.	

[9] See footnote 8.

Since 2015 two deployments per year have been undertaken by the ECOMMAS acoustic monitoring programme, allowing data to be recorded from April to November. This project is ongoing.

Since 2017, Northern Ireland moored acoustic deployments have been maintained at five locations as part of ongoing monitoring and the COMPASS and MarPAMM programmes. The COMPASS project has deployed acoustic moorings in both the North Channel and Skerries and the Causeway SACs in Northern Ireland. This is complemented by a dedicated headland count in Skerries and Causeway SAC.

The UK Bycatch Monitoring Programme and UK marine animal stranding schemes are ongoing. A UK Bycatch Mitigation Initiative is being developed in collaboration with industry and other stakeholders, to deliver a positive and coherent approach to understanding and mitigating bycatch.

Issues and opportunities

The assessments undertaken for the updated Marine Strategy Part One showed that, for most cetacean species, there are insufficient data to assess trends in the Greater North Sea.

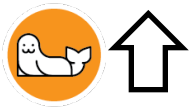
The power to detect trends and the confidence in our abundance assessments could be improved by increasing the frequency of the large-scale surveys such as SCANS, and also by incorporating more data from alternative sources.

The Joint Cetacean Data Programme is developing a database holding cetacean at-sea monitoring datasets collected by government, industry, academics and NGOs. The ambition is to provide an accessible, up-to-date resource of cetacean monitoring data that could be analysed in support of a wide range of conservation and policy needs.

The Agri-food and Biosciences Institute (AFBI) have also developed a towed survey method and integrated passive acoustic monitoring with an acoustic survey in the Irish Sea. These data could be incorporated into future indicator assessments.

Climate change, particularly warming seas, is expected to have indirect impacts on cetaceans, such as range shifts, possible increase in susceptibility to disease and contaminants and changes in the availability and abundance of food resources, particularly for whales which have specialised feeding habitats[10].

[10] Marine Climate Change Impacts: Report Card 2020 http://www.mccip.org.uk/impacts-report-cards/full-report-cards/2020/

SEALS D1 D4			
Overall summary	We propose that the monitoring of seals will be carried out largely by a number of existing programmes: - Seal Population Monitoring - UK Bycatch Monitoring Programme - Marine Animals Stranding Schemes		
Environmental Status in 2018		The UK achieved its aim of Good Environmental Status (GES) for grey seals in the Greater North Sea and Celtic Seas. There had been a significant increase in the abundance of harbour seals in West Scotland where the majority of harbour seals are located, but their status in other parts of the Celtic Seas was uncertain. Harbour seals in the Greater North Sea had not yet achieved GES.	
High level objective for GES	The population abundance and demography of seals indicate healthy populations that are not significantly affected by human activities.		
How progress towards GES is measured using monitoring, indicators and targets.			
Criteria	**Target**	**Indicators**	**Monitoring programmes**

Bycatch mortality	The long-term viability of seal populations is not threatened by incidental bycatch.	Marine mammal bycatch (OSPAR)	UK Bycatch Monitoring Programme Scottish Marine Animal Stranding Scheme (SMASS) Department of Agriculture, Environment and Rural Affairs (DAERA) marine mammal animal stranding investigations (Northern Ireland)
Population Abundance and Distribution	Population abundance and distribution are consistent with favourable conservation status.	Seal abundance and distribution (OSPAR)	Seal Population Monitoring
Grey seal pup production	Grey seal pup production does not decline substantially in the short or long-term.	Grey seal pup production (OSPAR)	Seal Population Monitoring
Operational targets	We will conduct research to: a. investigate potential causes of the harbour seal declines in Scotland, focusing on interactions with grey seals (competition and predation), predation from other marine mammals and exposure to toxins from harmful algae. b. investigate the life history parameters (e.g. survival and birth rates) and population dynamics of seals to improve our understanding of what is happening within these populations.		

	We will continue existing monitoring of bycatch of seals in fisheries, making improvement where required, and the identification of appropriate mitigation measures.
Monitoring programme details	
Seal population monitoring	The UK seal monitoring programme is run by the Sea Mammal Research Unit (SMRU), University of St Andrews. It undertakes systematic monitoring of all major breeding colonies for grey seals (~90% of the total pup production in the UK) and the entire coast of the UK (not just haulout sites) for harbour seals. Monitoring of the grey seal breeding colonies on the east coast of England and the smaller colonies in South West England, Wales, and some regions of Scotland such as Shetland is undertaken by a variety of groups, with information collated by SMRU. Harbour seal monitoring occurs on a rolling schedule with all areas surveyed at least once every five years (grey seal summer distribution is included). Haulout sites in the Moray Firth, Tay estuary and the Wash are surveyed annually. The major grey seal breeding colonies are monitored once every two years. In Northern Ireland, DAERA monitors breeding populations of harbour and grey seal at sites for which they are a designated feature (by land and sea).
UK Bycatch Monitoring Programme	The UK Bycatch Monitoring Programme reports bycaught seals through data from observers on fishing vessels.
Scottish Marine Animal Stranding Scheme (SMASS)	In Scotland, the SMASS, which contributes to Cetacean Strandings Investigation Programme (CSIP), monitors seal strandings around the Scottish coast to determine cause of death.
DAERA Marine Mammals Stranding Investigations	In Northern Ireland, DAERA monitor strandings of both grey and harbour seals and, where appropriate, post-mortems are undertaken by the Agri-food and Biosciences Institute (AFBI).
Developments in monitoring since 2014	
Through the continuation of the above monitoring programmes since 2014 the long time-series of data has been added to. This has helped develop and improve the abundance and distribution of seals indicator in the OSPAR marine mammal group, in which the UK plays a leading role. This resulted in successful assessments for seal abundance and grey seal pup production in the OSPAR Intermediate Assessment 2017. Similar assessments	

were carried out for seal abundance and grey seal pup production in UK waters for the updated UK Marine Strategy Part One.

Issues and opportunities

Expanding the UK Bycatch Monitoring Programme to cover more of the fisheries and regions identified as high risk would make the marine mammal bycatch indicator more robust and allow us to identify any threat from incidental bycatch more quickly and accurately.

Expanding the CSIP to include stranded seals in England and Wales would allow us to better understand the reasons for seals stranding in England and Wales. This would help to identify any human pressures that might be contributing to seal strandings and improve our understanding of the scale of incidental seal bycatch.

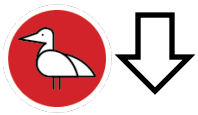
Research is ongoing in Scotland to investigate potential causes of the harbour seal declines along the Scottish coast in the Greater North Sea. Regular surveys will continue around the UK coast to monitor population abundance and trends.

We will explore the possibility of including additional seal population monitoring from other key colonies across the UK, for example; the Grey Seal population in Skomer and Ramsey Islands in Wales, which are monitored annually by Natural Resources Wales.

Research suggests that warming waters as a result of climate change can affect seals indirectly via changes in prey distribution and availability and increasing storms could dislodge pups from breeding sites.

BIRDS D1 D4

Overall summary	We propose that the monitoring of birds will be carried out largely by existing programmes. Data on marine bird abundance, distribution and breeding success are monitored by the following programmes: i) Seabird Monitoring Programme (SMP) ii) Wetland Bird Survey (WeBS) iii) Periodic bird surveys (various) Data on seabird bycatch are currently collected by the UK Bycatch Monitoring Programme

	Some other monitoring options are currently being explored through pilot projects (see below).		
Current Environmental Status in 2018		The UK achieved its aim of Good Environmental Status (GES) for non-breeding waterbirds in the Greater North Sea but not in the Celtic Seas. Breeding seabirds had not achieved GES.	
High level objective for GES	The abundance and demography of marine bird species indicate healthy populations that are not significantly affected by human activities.		
How progress towards GES is measured using monitoring, indicators and targets.			
Criteria	**Target**	**Indicators**	**Monitoring programmes**
Bycatch mortality	The long-term viability of marine bird populations is not threatened by deaths caused by incidental bycatch in mobile and static fishing gear.	Seabird bycatch	UK Bycatch Monitoring Programme
Population Abundance	The population size of marine bird species has not declined substantially since 1992 as a result of human activities	Marine bird abundance (OSPAR)	Seabird Monitoring Programme (SMP)
			Wetland Bird Survey (WeBS)
			Periodic bird surveys

Population demographic characteristics	Widespread lack of breeding success in marine birds caused by human activities should occur in no more than three years in six	Marine bird breeding success / failure (OSPAR)	SMP
		Kittiwake breeding success	
Distribution Range	There is no significant change or reduction in population distribution of marine birds caused by human activities.	Distribution of breeding and non-breeding marine birds	Periodic bird surveys Volunteer Seabirds At Sea monitoring programme (VSAS; pilot)
No set criteria	Reduce risks to island seabird colonies from non-native mammals (operational target).	Invasive mammal presence on island seabird colonies	UK invasive predatory mammal surveillance under the Biosecurity for LIFE project (pilot)
Operational targets	We will contribute to the further development of the assessment of bird populations and identify the most important pressures at a regional level through OSPAR. We will continue to enhance and protect marine birds through: a) effective management at protected sites; b) delivering the UK Plan of Action on Seabird Bycatch; c) reducing the risks to island seabird colonies from invasive predatory mammals; and d) achievement of the targets to reduce marine litter, particularly floating litter.		
Monitoring programme details			

Seabird Monitoring Programme (SMP)	The SMP is a partnership of 19 organisations, led by the Joint Nature Conservation Committee (JNCC). It provides annual trends in abundance and breeding success of seabirds at a sample of breeding colonies in the UK, Isle of Man, Channel Isles and the Republic of Ireland. Monitoring is conducted by volunteers and professionals. It also contributes to protected site monitoring, including Special Protection Areas (SPAs).
Wetland Bird Survey (WeBS)	The WeBS scheme is a partnership between Royal Society for the Protection of Birds (RSPB), British Trust for Ornithology (BTO) and JNCC. It provides annual trends in numbers of waterbirds at a sample of estuaries and coastal sites where they stop-over on migration or spend the winter. Surveys are conducted largely by a network of volunteers co-ordinated by BTO. It is also used to monitor protected sites, including SPAs.
Periodic bird surveys	Data from periodic surveys will continue to provide more comprehensive geographical coverage than the annual SMP and WeBS, which monitor a sample of sites. Data from periodic surveys provide estimates of the size of UK bird populations, complete snapshots of their distribution and help validate the population trends in SMP and WeBS data. Periodic surveys providing data for the UK marine bird indicators are: Breeding seabird censuses, including 'Seabirds Count' (coordinated by SMP) which will report in 2021; Bird Atlases of Britain and Ireland; Statutory Conservation Agency and RSPB Annual Breeding Bird Scheme (SCARABBS); Rare Breeding Bird Panel (RBBP); Non-Estuarine Waterbirds Survey (NEWS); the land-based arm of the European seaduck census; and Winter Gull Roost Survey (WinGS).
Volunteer Seabirds at Sea monitoring programme (VSAS) (pilot)	JNCC are leading the VSAS pilot project to assess whether information on the distribution and abundance of seabirds at sea could be collected using volunteers on 'ships of opportunity' (ferries, research cruises, etc.).
UK invasive predatory mammal surveillance	Improved surveillance of invasive predatory mammals is currently being developed by the Biosecurity for LIFE project, an EU/RSPB/Natural England /Scottish Natural Heritage project which runs from 2018 to 2022 (https://biosecurityforlife.org.uk/).

under the Biosecurity for LIFE project (pilot)	
UK Bycatch Monitoring Programme	Seabird bycatch is currently monitored by dedicated observers as part of the UK Bycatch Monitoring Programme. This data meets our statutory obligations and supports the implementation of the UK Plan of Action on seabird bycatch.

Regional Cooperation

Data from the SMP, WeBS and periodic bird surveys are used in the OSPAR common indicators on marine birds. Data from VSAS is fed into the European Seabirds at Sea Database (ESAS). Some ESAS data are being used to develop OSPAR indicators of abundance and distribution of seabirds at sea.

Developments in monitoring since 2014

The SMP and WeBS are long-established and their continuation since 2014 has added to a long time-series of data that have been used in the indicators listed above for the OSPAR Intermediate Assessment 2017, and the assessments used for the updated Marine Strategy Part One.

Since 2017, VSAS has begun to provide at sea monitoring of seabird abundance and distribution. JNCC has developed a training programme for volunteers and a bespoke app to facilitate data capture, validation and storage. The first volunteer-led surveys were completed in 2018.

Issues and opportunities

Expanding the UK Bycatch Monitoring Programme would improve confidence in our assessments and give us a better understanding of the extent of seabird bycatch in UK waters.

Following the VSAS pilot, further research and development will be required to determine whether additional targeted surveys are required to fill high-priority gaps in distribution pattern monitoring. We are also considering targeted aerial and boat-based surveys of high priority species, such as Balearic shearwater, at-sea and the potential of tracking data to deliver seabird state-pressure relationships.

We will explore the potential of expanding surveillance of invasive predatory mammals on seabird island SPAs and other important sites as part of the Biosecurity for LIFE project.

We will also explore the possibility of including additional periodic bird surveys from selected offshore sites across the UK, for example; Common Scoters and Red Throated Divers as part of SPA monitoring in Wales. At-sea data collected in the European seaduck census could also be incorporated into the bird indicators in future.

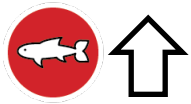
Trend information on non-breeding marine waterbirds, with distributions within sight of land, will come from land-based WeBS and NEWS surveys. Supplementing these with surveys of high priority non-breeding marine waterbird species, with distributions beyond sight of land, would be beneficial, as would augmenting these with marine SPA monitoring data.

Research and development are needed to determine whether:

- surveys can identify distribution pattern changes of the Critically-Endangered (IUCN Red List) Balearic shearwater in UK waters;
- tracking can identify seabird state-pressure relationships; and
- the marine bird abundance indicator can accommodate data collected at sea.

It is likely that changing climate will affect seabirds, for example, by changing the distribution and availability of prey. In future, direct impacts on breeding sites and habitats from changes in severe weather events and sea level rise may become of increasing importance.

FISH D1 D4	
Overall summary	We propose that the monitoring of fish will be carried out largely by existing programmes. Data on abundance, distribution, bycatch and habitat of fish are collected by: (i) Otter trawl surveys (ii) Beam trawl surveys (iii) Coastal and estuarine monitoring (iv) Fisheries dependent data (including landings data at port and from logbook data) and catch data from the observer

	programmes		
Environmental Status in 2018		Demersal fish communities were recovering from over-exploitation in the past, but Good Environmental Status (GES) had not yet been achieved in either the Greater North Sea or the Celtic Seas. A partial assessment of pelagic shelf fish did not provide a clear result.	
High level objective for GES	The abundance and demography of fish indicate healthy populations that are not significantly affected by human activities.		
How progress towards GES is measured using monitoring, indicators and targets.			
Criteria	**Target**	**Indicators**	**Monitoring programmes**
Bycatch mortality	Incidental bycatch is below levels which threaten long-term viability and recovery of fish populations.	Bycatch rate or risk for listed fish species	Official catch and effort data (including Vessel Monitoring System, VMS) for fisheries including from observer programmes
Population Abundance	The population abundance of sensitive species is not decreasing due to anthropogenic activities and long-term viability is ensured.	Recovery in the population abundance of sensitive fish species (OSPAR)	Otter trawl surveys Beam trawl surveys
Distributional Range	For each fish species listed in the Habitats Regulations population abundance and geographic	Distributional range for fish species in the Habitats Regulations	Coastal and estuarine surveys

	distribution meets established favourable reference values.		
Species Habitat	For listed fish species the area and the quality of the habitat is sufficient.	Assessments of species habitat for listed fish species	Coastal and estuarine surveys Otter trawl surveys Beam trawl surveys
Operational targets	We will work together with other countries in OSPAR to establish appropriate threshold values where this is feasible.		
Monitoring programme details			
Otter trawl surveys, including International Bottom Trawl Survey	UK research vessels participate in many of the international trawl surveys for fisheries, including the International Council for the Exploration of the Seas coordinated International Bottom Trawl Survey (IBTS). These bottom trawl surveys mainly provide data on demersal species. The IBTS has been undertaken in the North Sea during the first quarter of the year since 1983 and in the third quarter since 1998. IBTS has been undertaken in waters to the west of Scotland during the first quarter since 1985 and in the fourth quarter since 1995. In the Irish sea IBTS surveys have been run in quarter 1 and quarter 4 since 1992. A Scottish Deep Water Slope Survey including Rockall Bank has been conducted since 1998.		
Beam Trawl Surveys	The English contribution to the ICES coordinated beam trawl surveys comprise the English Beam Trawl surveys (EBT) and the English Ecosystem Survey. The English Beam Trawl surveys cover the Irish Sea, Bristol Channel, and English Channel and the English Ecosystem Survey collect data from the Celtic Sea and Western Channel. Similar surveys have been carried out in Welsh waters from 2016 to date. These annual surveys focus on flatfish fish species (e.g. sole and plaice). Marine Scotland conduct a dredge trawl survey in the Firth of Forth and around Turbot Bank.		
Coastal and Estuarine	Data are collected for estuarine and coastal fish by the Environment Agency, Scottish Environment Protection Agency, Natural England,		

surveys	the Agri-food and Biosciences Institute (AFBI) and the Department of Agriculture, Environment and Rural Affairs (DAERA, Northern Ireland). These data support assessments of species listed by the Bern Convention and contribute toward the assessment of ecological status under the River Basin Management Plans (RBMPs). The Northern Ireland Fish surveys also cover transitional waters and the ten regional Inshore Fisheries and Conservation Authorities (IFCAs)[11] in England undertake inshore monitoring programmes.

Regional Cooperation

Since 2012, the UK has worked in OSPAR to develop new OSPAR-wide indicators for fish communities covering population abundance of sensitive fish species. UK data was included in the associated assessments which were published in the OSPAR Intermediate Assessment 2017.

Data collection is conducted to meet the needs of international (International Council for the Exploration of the Sea, ICES) and national stock assessment and advice to support fisheries management.

Developments in monitoring since 2014

The English Ecosystem Survey of the Celtic Sea and Western Channel (beam trawl) was started in 2006 and extended to include the northern Celtic Sea in 2013. Since 2017, additional ecosystem information for benthic habitats and food webs has been collected.

The Pelagic Ecosystem survey was started in 2012 in English waters of the western English Channel, the Bristol Channel and Celtic Sea to monitor the pelagic food web. In 2016, the Pelagic Ecosystem survey data for 2013 to 2016 contributed to ICES Stock Assessments for sprat in the English Channel. The sardine data are currently being considered for inclusion in the assessment of sardine in the Celtic Sea and western Channel. Additional data is provided to working groups for mackerel, horse mackerel and anchovy. In 2017, the survey was extended to include the French waters of the western Channel. Important biological data is also collected for black seabream, seabass, garfish, saury pike, red mullet and increasingly observations are made for bonito and bluefin tuna.

Bottom trawl and ground fish surveys of the North Sea and west coast fish communities have continued uninterrupted, lengthening the existing time series. There have been some changes to the quality assurance processes put in place to ensure consistency of data formats, units and assumptions between the countries submitting data.

[11] http://www.association-ifca.org.uk/common-fisheries-policy/technical-advisory-group

There has also been a programme of research to improve the fishing gear used for scientific surveys to improve its usability and effectiveness.

The UK is fulfilling a commitment to modernise its inshore fleet with appropriate and proportionate vessel monitoring and tracking systems.

Issues and opportunities

Additional coastal and estuarine data collected by Non-Governmental Organisations (NGOs)/citizen science initiatives should be considered for analysis to support future assessments.

Further sampling programmes, in co-operation with the fishing industry, are needed to boost current monitoring efforts for sensitive elasmobranch species (sharks and rays) in UK waters and fill the gap in monitoring of sensitive species. The Environment Agency, Natural Resource Wales, Scottish Environment Protection Agency and DAERA have carried out fish monitoring in estuarine waters over a number of years and these data could be used to contribute to an inshore fish indicator[12]. In addition, many commercial fish species use the estuarine environment as nursery and overwintering areas and the data from these programmes can make a significant contribution to the understanding of life–cycle ecology of these species.

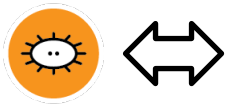
Existing assessments of rare species across all fish taxa is hindered by a lack of data. Logbook data from commercial fisheries provide data with a broad geographical coverage, but rare fish can be difficult to identify to species level and therefore data can be inaccurate. Observer programmes accurately identify rare species and therefore provide high quality data, but the data is too sparse to give a high-confidence assessment of rare species.

Subject to the outcomes of technology testing, from 2021 we expect new legislation to be implemented requiring all British licensed fishing vessels under 12m to have inshore VMS. This will mean that more data with the potential to be used for understanding fishing patterns should come on stream over the next few years.

Direct impacts of climate change can affect physiology and behaviour and alter growth, reproductive capacity, mortality and distribution. Warming temperatures have already been seen to affect spawning among species. Indirect effects alter the productivity, structure and composition of the marine ecosystems on which fish depend for food. Recent studies suggest that warming sea temperatures could result in smaller fish sizes.

[12] https://data.gov.uk/dataset/41308817-191b-459d-aa39-788f74c76623/trac-fish-counts-for-all-species-for-all-estuaries-and-all-years

<table>
<tr><th colspan="4">PELAGIC HABITATS D1D4</th></tr>
<tr><td>Overall summary</td><td colspan="3">We propose that the monitoring of distribution and condition of pelagic habitats will be carried out largely by existing monitoring programmes:

Data on distribution and condition of pelagic habitats are collected by the following programmes:
(i) Fixed point sampling
(ii) The Continuous Plankton Recorder (CPR)
(iii) The Environment Agency’s inshore programme</td></tr>
<tr><td>Environmental Status in 2018</td><td colspan="2">  </td><td>Prevailing environmental conditions were likely to be driving the observed changes in plankton communities but human activities could not be ruled out and it was uncertain whether Good Environmental Status (GES) has been achieved.</td></tr>
<tr><td>High level objective for GES</td><td colspan="3">Pelagic habitats are not significantly adversely affected by human activities.</td></tr>
<tr><td colspan="4">How progress towards GES is measured using monitoring, indicators and targets.</td></tr>
<tr><td>Criteria</td><td>Target</td><td>Indicators</td><td>Monitoring programmes</td></tr>
<tr><td>Habitat distribution and condition</td><td>The structure, function, composition and abundance of the plankton community is not significantly adversely influenced by anthropogenic drivers.</td><td>Changes in plankton communities (OSPAR)

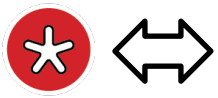
Changes in plankton biomass and abundance (OSPAR)</td><td>Fixed point sampling

CPR</td></tr>
<tr><td>Operational</td><td colspan="3">We will work with other countries in OSPAR to:</td></tr>
</table>

targets	a) Understand and quantify the effects of the key anthropogenic and natural pressures on pelagic habitats; and b) Further develop and test regional assessment methods that can be used in the future for assessing the status of pelagic habitats.
Monitoring programme details	
Coastal fixed point and inshore sampling	Coastal pelagic habitats are monitored by a network of up to 15 fixed sampling points around the UK, as well as the Environment Agency's inshore sampling programme. Some sites collect zooplankton and phytoplankton samples, some only collect phytoplankton data. Instrumented moorings at some of these fixed sampling points will provide additional supporting physical and chemical data. The fixed point samples are supplemented by vessel-based spot samples. Data collected are often used for multiple purposes, e.g. River Basin Management Plans (RBMPs), Urban Waste Water Treatment Regulations (UWWTR) and OSPAR. Fixed point sampling is distributed around the UK coast of England, Wales and Scotland, plus two stations in the Irish Sea sampled by AFBI-NI. Sites are selected to ensure they encompass all the water types with distinct ecological and hydrological characteristics found in UK coastal and shelf waters. Samples are collected at regular intervals throughout the year, gathering quantitative information on the abundance of species that make up the plankton. Where appropriate, the monitoring programme makes use of existing monitoring programmes run by the Agriculture, Food and Biosciences Institute - Northern Ireland (AFBI), the Centre for Environment, Fisheries and Aquaculture Science (Cefas), Environment Agency, Marine Scotland, Scottish Association of Marine Science, Plymouth Marine Laboratory, the Scottish Environmental Protection Agency and the Department of Agriculture, Environment and Rural Affairs (DAERA).
Continuous Plankton Recorder	Offshore pelagic habitats are monitored by the CPR, operated by the Marine Biological Association (MBA). The CPR uses ships of opportunity on commercial shipping routes to collect plankton samples in UK waters and beyond. Established in 1931, the CPR provides long-term time-series data on the state of plankton (including both phytoplankton and zooplankton) at a large scale in offshore locations.

Regional Cooperation
Implementation of the indicators at the OSPAR level is collaborative, with all Contracting Parties who have data (currently UK, Sweden, and France) using the same analysis methods to ensure consistency across the OSPAR region. This process is coordinated by the UK as chair of the OSPAR Pelagic Habitats Expert Group.
Developments in monitoring since 2014
The technical approach to phytoplankton monitoring remains relatively unchanged, although the potential of flow cams, flow cytometry and remote sensing are being investigated to see if they can be used in routine monitoring.
Issues and opportunities
Current plankton monitoring covers multiple trophic levels at the base of the food web, required to identify changes in pelagic habitats. Since 2014, UK plankton monitoring has reduced resulting in reduced spatial and temporal density of sampling. There are monitoring gaps in some parts of the food web (e.g. picoplankton) and some nearshore hydrodynamic features (e.g. large estuary “plumes”). Data density is variable so there may also be gaps in some less accessible regions. Some technical innovations such as flow cytometry, flow cams (and possibly eDNA and DNA barcoding) may help to improve monitoring effectiveness. Some areas are poorly monitored e.g. offshore and coastal areas to the west of Scotland, which reduces ability to perform a robust assessment. There are widespread effects in some plankton groups due to climate change in particular for plankton growth and distribution in conjunction with temperature shifts, and this trend is likely to continue. This is likely to impact higher trophic levels and ecosystem services. In future ocean acidification has the potential to negatively affect plankton species that build carbonate shells[13]. Plankton communities are possibly also experiencing direct anthropogenic pressures, particularly in coastal regions and in river plumes.

[13] Marine Climate Change Impacts: Report Card 2020 http://www.mccip.org.uk/impacts-report-cards/full-report-cards/2020/

BENTHIC HABITATS D1 D6		
Overall summary	We propose that the monitoring of benthic habitats will be carried out largely by a number of existing programmes. Data on habitat loss, condition, and adverse effects and disturbance caused by human activities will be collected by: i) Inshore benthic Marine Protected Area (MPA) Monitoring Programmes ii) Offshore and deep sea MPA monitoring programme iii) Marine biodiversity and Climate change (MarClim) Monitoring Programme iv) River Basin Management Plan (RBMP) Monitoring Programme	
Environmental Status in 2018		The achievement of Good Environmental Status (GES) was uncertain for intertidal and soft sediment habitats. The levels of physical damage to soft sediment habitats were considered to be consistent with the achievement of GES in UK waters to the west of the Celtic Seas, but not in the Celtic Seas or in the Greater North Sea.
High level objective for GES	The health of seabed habitats is not significantly adversely affected by human activities.	

How progress towards GES is measured using monitoring, indicators and targets.			
Criteria	**Target**	**Indicators**	**Monitoring programmes**
Spatial extent of physical loss	The physical loss of each seabed habitat type caused by human activities is minimised and where possible	Physical loss of predicted habitat	Inshore benthic MPA monitoring programmes Offshore and deep sea MPA monitoring programme

	reversed		
Habitat condition	Habitat loss of sensitive fragile or important habitats caused by human activities is prevented, and where feasible reversed.	Physical loss of predicted habitat	Inshore benthic MPA Monitoring Programmes Offshore and deep sea MPA monitoring programme
Spatial extent of habitat type adversely affected by physical disturbance	The extent of habitat types adversely affected by physical disturbance caused by human activity should be minimized.	Extent of physical damage indicator to predominant and special habitats (OSPAR) Benthic communities indicator (OSPAR)	Inshore benthic MPA Monitoring Programmes Offshore and deep sea MPA monitoring programme
Extent of adverse effects	The extent of adverse effects caused by human activities on condition, function and ecosystem processes of habitats is minimised.	Benthic communities indicator (OSPAR)	Inshore benthic MPA monitoring programmes Offshore and deep sea MPA monitoring programme
		Aggregated Infaunal Quality Index Aggregated Saltmarsh Tool	RBMP Monitoring Programme

		Aggregated Rocky Shore Macroalgal Index Aggregated Intertidal Seagrass Tool	
		Intertidal rock community change indicator (MarClim)	MarClim Monitoring Programme
Operational targets	We will work with other countries in OSPAR to establish criteria and thresholds for the extent of habitat loss and the extent of anthropogenic activities where feasible. We will complete a well-managed ecologically coherent MPA network.		
Monitoring programme details			
Current inshore benthic MPA monitoring programmes	All monitoring is carried out between mean high water (MHW) and the 12nm line. **English inshore waters:** Monitoring needs are identified by Natural England and delivered with partners including the Environment Agency, Cefas, the IFCAs, and the JNCC. Currently, benthic features (selected using a rolling risk-based approach) within MPAs are monitored each year. Currently, monitoring is conducted within 12-16% of English inshore MPAs, targeting 10-14% of habitat examples. **Scottish inshore waters:** Nature conservation-related monitoring needs are identified by Scottish Natural Heritage (SNH) and delivered with partners including Marine Scotland Science, academic institutes and industry. Current monitoring focuses on the suite of MPAs and is prioritised annually under the framework established by the Scottish MPA Monitoring Strategy. Detailed monitoring is conducted at a small number of		

	MPAs only. Other ad hoc, or research-focused monitoring may also take place and, where appropriate, be incorporated into MPA assessments. The Scottish Environment Protection Agency (SEPA) coordinates and undertakes RBMP-related benthic monitoring around Scotland. **Welsh inshore waters:** Monitoring needs are identified by Natural Resources Wales (NRW) and the monitoring programme receives governance and strategic steer from the NRW Marine Programme Board and the NRW Evidence Board. NRW has a specific monitoring programme that primarily supports delivery of obligations under the Habitats Regulations and the RBMP, but also contributes to other monitoring and reporting obligations. The monitoring programme focuses available resources on a selection of benthic features in a risk-based cycle. Current monitoring is largely limited to five SACs and one Marine Conservation Zone (MCZ), with monitoring of other MPAs and the wider seas occurring incidentally as part of SAC, MCZ and RBMP monitoring. **Northern Irish inshore waters:** Northern Irish inshore benthic habitats are monitored as part of established programmes for MPAs and River Basin Management Plans. Monitoring needs are identified by the Department of Agriculture, Environment and Rural affairs (DAERA), and delivered with partners including the Agri-food and Biosciences Institute (AFBI). At present, monitoring takes place in a six-year rolling cycle and a selection of MPAs are prioritised and monitored each year. AFBI have monitored a selection of six sites in the Irish Sea annually since 1997 as part of the Clean Seas Environmental Monitoring Programme (CSEMP). Other ad hoc or research-focused monitoring may also take place, and data will be incorporated into assessments where appropriate.
Current offshore and deep sea MPA monitoring programme	**UK offshore habitats:** Dedicated monitoring of offshore MPAs has been taking place since 2014. Current monitoring for offshore benthic habitats focuses on MPAs beyond 12nm. A small selection of offshore MPAs are monitored each year by JNCC and partners including Cefas, Marine Scotland Science and AFBI. MPA monitoring is prioritised on a yearly

	basis, based on factors including risk from physical abrasion pressure and amount of data available. **UK deep sea habitats:** Dedicated monitoring of deep sea MPAs has been taking place since 2016. Current monitoring of deep sea benthic habitats focuses on deep sea (below 200m water depth) MPAs. A small selection of offshore MPAs are monitored each year by JNCC and partners including Cefas, the National Oceanography Centre and Marine Scotland Science. MPA monitoring is prioritised on a yearly basis, based on factors including risk from physical abrasion pressure and amount of data available. Other ad hoc or research-focused monitoring may also take place, and data will be incorporated into assessments where appropriate.
RBMP Monitoring programmes	Data from a number of other programmes that assess the status of benthic habitats will continue to be collated to inform our assessments. This includes monitoring associated with the RBMPs (where benthic habitats are assessed using the Infaunal Quality Index, Saltmarsh Tool, intertidal seagrass tool, and Rocky Shore Macroalgal Index), monitoring associated with SACs, the Clean Seas Environmental Monitoring Programme, Marine Conservation Zones, UK Oil and Gas industry, and Regional Environmental Characterisation
MarClim Monitoring Programme	Monitoring of intertidal rocky shore habitats through the MarClim monitoring programme produces data for the MarClim indicator, which assesses the response of rocky shore communities to climate change pressures. This is one of the oldest long-term datasets in the UK. Annual surveys are carried out at over 100 sites around the UK coastline[14].
Regional Cooperation	
Difference in methods and approaches make regional cooperation for benthic monitoring challenging at the operational level, however, attempts have been made to increase regional cooperation. For example, the 2013-2015 project 'Towards a joint monitoring programme for the North Sea and Celtic Sea' made recommendations for a shared sampling design for benthic habitats which, if implemented, would increase regional	

[14] For further information: http://www.marclim.co.uk/index.php?sec=info

cooperation. There are also some examples of regional cooperation at the MPA level for international sites such as Dogger Bank SAC.

Developments in monitoring since 2014

The 2014 UK Marine Strategy Part Two document noted the gap our monitoring of the condition of sediment, biogenic and rock habitats and the need to monitoring benthic communities. Since 2014, a new programme of MPA monitoring has been established within the offshore and deep-sea environments, collecting data on a range of features to address this gap. 28 out of a possible 65 offshore and deep-sea MPAs designated for habitat features have been monitored by JNCC and their partners.

Issues and opportunities

Increasing levels of UK benthic habitat monitoring would improve our ability to provide confident assessments of the change in status and trends. Currently, only a small selection of MPAs is able to be monitored at a reasonable frequency, and there is no monitoring being undertaken within the wider benthic environment.

Incorporating other types of data would also strengthen and improve confidence in our assessments of benthic habitats including:

- high resolution inshore fisheries data to improve the indicator results that are obtained through modelling, such as physical loss and physical damage;
- more standardised human activity data from non-fisheries activities, which could be transformed into pressure data. This could help to understand the effects of cumulative pressures and guide monitoring design; and
- using indicators of benthic habitat condition at the appropriate spatial and temporal scales to improve our understanding of the status of benthic habitats.

Increases in temperature and decreases in pH as a result of climate change may have an effect on benthic habitats, for example by shifting the distribution range and abundance of some infaunal species or by reducing the ability of corals to grow as water pH reduces and the calcium carbonate saturation horizon becomes more shallow[15]. We are already using the MarClim indicator to monitor some of these.

[15] Marine Climate Change Impacts: Report Card 2020 http://www.mccip.org.uk/impacts-report-cards/full-report-cards/2020/

NON-INDIGENOUS SPECIES D2

Overall summary	The monitoring of non-indigenous species (NIS) is carried out largely by existing programmes: i) Clean Seas Environmental Monitoring Programme (CSEMP), ii) Groundfish surveys (GFS), iii) Regional Seabed Monitoring Plan (formerly Aggregate Levy Sustainability Fund) (RSMP), iv) Dredge disposal site monitoring, v) Marine Protected Area (MPA) monitoring, vi) River Basin Management Plans (RBMPs) monitoring and vii) Continuous Plankton Recorder (CPR). This is complemented by non-statutory citizen science projects and data records on the National Biodiversity Network (NBN) gateway.	
Environmental Status in 2018		The UK did not achieve its aim of Good Environmental Status (GES) for NIS. Our ability to detect new NIS had improved but there had been no significant change in the number of new records of NIS made between 2003 and 2014.
High level objective for GES	The rate of introduction of NIS, spread and impact of invasive NIS caused by human activities is not adversely altering ecosystems.	

How progress towards GES is measured using monitoring, indicators and targets.

Criteria	Target	Indicators	Monitoring programmes
NIS introductions and NIS distribution	The number of newly introduced NIS is minimised and where possible reduced to zero; and The rate of spread of invasive NIS, as a result of human activities is minimised and reduced where	The number of new NIS introduced (OSPAR); and The number of new populations of established invasive NIS.	Clean Seas Environmental Monitoring Programme (CSEMP) Groundfish surveys (GFS) Regional Seabed Monitoring Plan (formerly Aggregate Levy Sustainability Fund) (RSMP)

	possible.		Dredge disposal site monitoring
			Marine Protected Area (MPA) monitoring
			RBMP monitoring
			Continuous Plankton Recorder (CPR)
Monitoring programme details			
River Basin Management Plan (RBMP) monitoring	Intertidal and subtidal surveys using multiple methods, collecting data on a range of algal and mobile and non-mobile animal species and non-trawl capture of fish. Monitoring is conducted in England, Scotland, Wales and Northern Ireland, but different elements of the programme are implemented over different time scales. Some surveys are undertaken opportunistically, but all surveys are conducted at a frequency of between bi-annually and every six years.		
Marine Protected Areas (MPA) monitoring	Observations and grab samples taken in England, Scotland, Wales and Northern Ireland and offshore. Grab samples monitor benthic infauna (animal species living within the seabed) and smaller epifauna (organisms living attached to the surface of the seabed or other organisms) whereas the observations collect data on larger animal and algal species. Marine Conservation Zone sites are currently visited for site verification and baseline condition with specific monitoring programmes put in place after designation. Special Areas of Conservation and Areas of Scientific Interest are visited on a six-year cycle and monitoring is site specific (minimum frequency every 18 years, maximum every four years).		
Regional Seabed Monitoring Plan (RSMP)	Grab and occasional trawl sampling of benthic infauna and smaller epifauna conducted in England and Wales.		
Ground Fish Surveys (GFS)	Trawl sampling of benthic epifauna including larger and more mobile species, conducted annually between July and October in Scotland, England and Wales.		

Clean Seas Environmental Monitoring Programme (CSEMP)	Trawl and water sampling of benthic epifauna and some planktonic species. Sites in England, Wales, and Northern Ireland are monitoring on a rolling basis every other year. Scottish sites are monitored on a six yearly, three yearly or annual basis according to the site concentrations in relation to Background Assessment Concentrations (BACs) and Environmental Assessment Criteria (EACs). Northern Ireland sites are monitored annually.
Dredge Disposal and other industry data	Grab sampling of benthic infauna and smaller epifauna across England, Wales and Northern Ireland. Frequency of monitoring is site specific depending on frequency and quantity of dredge disposal activities.
Continuous Plankton Recorder[16] (CPR)	Ad-hoc non-statutory zooplankton monitoring across England, Wales and Scotland.
Capturing our Coast	A non-statutory observational annual survey across England, Wales and Scotland. This is comprised of transects and quadrats conducted via underwater cameras, walkovers, or divers.
Invasive Species Ireland	A non-statutory recording scheme for invasive species on the island of Ireland[17].
Regional Cooperation	
NIS monitoring is reliant upon regional cooperation. The monitoring of NIS in the UK follows recommendations from OSPAR (i.e. with respect to monitoring NIS as part of wider biodiversity monitoring) and provides data for incorporation into OSPAR level assessments.	
Developments in monitoring since 2014	
In response to the lack of existing monitoring, NIS monitoring was integrated into ongoing statutory biodiversity monitoring programmes across the UK from 2016 as an efficient and cost-effective option. NIS data provided by these statutory monitoring programmes are currently complemented by non-statutory data sources collected via citizen science and data records on the National Biodiversity Network Atlas.	

[16] https://www.cprsurvey.org/services/the-continuous-plankton-recorder/

[17] Records from Northern Ireland are added to the NBN Atlas.

Issues and opportunities
NIS data collection is currently undertaken by monitoring programmes set up for other purposes, which are not necessarily optimised for NIS monitoring. For example, the frequency and location of data collection might not be designed for NIS monitoring, or there may be inconsistency between methodologies used on surveys designed for other purposes. There is currently limited coverage of locations at high risk of introduction of NIS (e.g. marinas). Climate change may alter feeding interactions throughout the food web and ocean currents, indirectly facilitating the introduction of new NIS species.

COMMERCIAL FISH D3		
Overall summary	The monitoring of commercial fisheries is carried out by a number of existing monitoring surveys, along with a range of port sampling and observer programmes.	
Environmental Status in 2018		The UK achieved its aim of Good Environmental Status (GES) for some commercially exploited fish. In 2015, 53% of marine fish (quota) stocks were fished below maximum sustainable yield (MSY). Most national shellfish stocks had either not yet achieved GES or their status was uncertain. The percentage of quota stocks fished below MSY and the proportion of marine fish spawning stock biomasses capable of producing MSY had increased significantly since 1990.
High level objective for GES	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.	

How progress towards GES is measured using monitoring, indicators and targets.			
Criteria	**Target**	**Indicators**	**Monitoring programmes**
Fishing mortality	The fishing mortality rate of populations of commercially-exploited species is at or below levels which can produce the maximum sustainable yield.	Commercial fishing pressure for stocks of UK interest.	All monitoring programmes listed below
Reproductive capacity of the stock	The Spawning Stock Biomass of populations of commercially-exploited species are above biomass levels capable of producing the maximum sustainable yield.	Reproductive capacity of commercially exploited stocks of UK interest.	All monitoring programmes listed below
Monitoring programme details			
Bottom trawl surveys	UK research vessels participate in International Council for the Exploration of the Sea (ICES) coordinated bottom trawl surveys that focus on demersal fish species (e.g. cod, haddock, whiting, monkfish). These are carried out by Agri-food and Biosciences Institute (AFBI) in the Irish Sea in quarters 1 and 4; by the Centre for Environment, Fisheries and Aquaculture Science (Cefas) in the North Sea in quarter 3; and by Marine Scotland Science in quarters 1 and 3 in the North Sea and quarters 1 and 4 for the West of Scotland Area.		
Beam trawl surveys	The English contribution to the ICES coordinated beam trawl surveys comprise the English Beam Trawl surveys (EBT) and the English Ecosystem Survey. The English Beam Trawl surveys cover the Irish Sea, Bristol Channel, and English Channel and the English		

	Ecosystem Survey collect data from the Celtic Sea and Western Channel. Similar surveys have been carried out in Welsh waters from 2016 to date. These annual surveys focus on flatfish fish species (e.g. sole and plaice). Marine Scotland conduct a dredge trawl survey in the Firth of Forth and around Turbot Bank.
Pelagic fish surveys	Annual acoustic surveys are carried out across the UK for herring and sprat as part of the ICES coordinated pelagic fish surveys. These cover sites in the North Sea, Irish Sea, Celtic Sea and Western Channel, and a number of sampling stations in Welsh waters.
Underwater television surveys	Annual, bi-annual and ad-hoc ICES coordinated underwater television surveys for *Nephrops* are carried out across the UK. These take place in the Irish Sea, Botney Gut, Silver Pit, Farne Deeps, Fladen Ground, Firth of Forth, Moray Firth, North Minch, South Minch, Clyde, Jura, Devil's Hole. Annual surveys of king scallop populations are also undertaken in unfished areas in English waters.
Coastal surveys	Site-specific trawl surveys for sea bass, queen scallops and king scallops in are carried out in Welsh waters. In England, trawl surveys for pre-recruitment bass are carried out in the Solent and Chichester. Coastal surveys are also conducted in Northern Irish waters as part of the Irish Sea queen scallop survey.
Sea angling programme	Annual UK-wide survey under the Data Collection Framework of recreational catches of species used in stock assessments, for example, sea bass.
Fisheries dependent data	UK-wide observer programmes and routine monitoring of fisheries landings data for logbooks and port records. At port data collection for landed crab and lobster in England. Industry sampling scheme for king scallop in English waters, providing scallop size and age data.
Supporting data	A range of additional surveys inform our assessments. These include the Scottish Deep Water Slope Survey at Rockall Bank; the Scottish quarter 4 surveys for sandeels off the Firth of Forth and around Turbot bank; the Scottish triennial contribution to the International Mackerel and Horse Mackerel Egg Survey; and the Fishery Science

	Partnership Western Channel Flatfish Beam trawl survey in English waters.

Regional Cooperation

Data collection is conducted to meet the needs of international (ICES) and national stock assessment and advice to support fisheries management.

Other notable international cooperation – beyond the ICES coordinated surveys described above - includes contributions the International Blue whiting spawning stock survey (Northeast Atlantic), and to the International Ecosystem Survey in the Nordic Seas (Atlanto-Scandinavian Herring “ASH” acoustic survey for both herring and blue whiting, ICES area IIa Norwegian Sea).

It should also be noted that the monitoring programmes for Descriptor 3 (particularly the fisheries independent data) also support all current OSPAR indicators for fish communities for Descriptors 1 and 4.

Developments in monitoring since 2014

Both the onshore and offshore programmes have been improved to make them more statistically robust and effective.

The Pelagic Ecosystem survey was developed under project POSEIDON (starting in 2012 in English waters of the western English - and Bristol Channel and Celtic Sea) to monitor the pelagic food web. Since 2016 it was incorporated in the European Data Collection Framework. In 2016, the short time series (starting in 2013) has contributed to ICES Stock Assessments for sprat in the English Channel and, currently, the sardine data are being considered for inclusion in the assessment of sardine in the Celtic Sea and western Channel. Additional data is provided to working groups for mackerel, horse mackerel and anchovy. In 2017, the survey was extended to include the French waters of the western Channel. Important biological data is also collected for black seabream / seabass / garfish / saury pike / red mullet and increasingly observations are made for bonito and bluefin tuna.

Bottom trawl and ground fish surveys of the North Sea and west coast fish communities have continued uninterrupted, lengthening the existing time series. There have been some changes to the quality assurance processes put in place to ensure consistency of data formats, units and assumptions between the countries submitting data.

There has also been a programme of research to improve the fishing gear used for scientific surveys to improve its usability and effectiveness.

Issues and opportunities

Limited information on national shellfish stocks (crab, lobster, and scallop) is available relative to biomass reference points for MSY (for reproductive capacity). This is due in part due limited coastal monitoring. Additionally, though stock assessments are in place for these species, they have only been implemented relatively recently and more time is needed develop a long enough time series to improve the accuracy of MSY estimates. Beyond this, the growing fishery for Channel cuttlefish, whelks and queen scallops requires increased monitoring. Research and development are underway to improve monitoring for cuttlefish and queen scallops, and there are plans to establish formal stock assessments for the whelks and queen scallops.

Climate change is likely to affect commercial fish, including by driving changes in primary production that will in turn affect fish stock recruitment for some species. We may also see an increase in warmer water species in UK waters, and a decrease in cold water species. Ocean acidification may affect shellfish species[18].

FOOD WEBS D4		
Overall summary	We propose that the monitoring evidence food webs will be delivered largely by existing monitoring programmes. Data on trophic guilds (a group of organisms or species sharing the same function within the food web and having shared nutritional relationships), fish community (species and size) composition and productivity are collected by the following programmes: i) Fisheries surveys ii) Plankton surveys iii) Remote sensing of chlorophyll and primary production iv) Seal Population Monitoring (SPM) v) Seabird Monitoring Programme (SMP) vi) Seabirds at Sea Monitoring Programme (SSMP) vii) Small Cetaceans in European Atlantic waters and the North Sea (SCANS) surveys	
Environmental Status in 2018		The extent to which Good Environmental Status (GES) has been achieved is uncertain: plankton communities are changing; some fish

[18] Marine Climate Change Impacts: Report Card 2020 http://www.mccip.org.uk/impacts-report-cards/full-report-cards/2020/

		communities are recovering, but others are not; breeding seabird populations are in decline; grey seal numbers are increasing and trends in cetacean populations are unclear. It is known that components of the marine food web are changing, but it is not clear how they are affecting each other.	
High level objective for GES	The health of the marine food web is not significantly adversely affected by human activities.		
How progress towards GES is measured using monitoring, indicators and targets.			
Criteria	**Target**	**Indicators**	**Monitoring programmes**
Trophic Guild diversity	The species composition and relative abundance within representative feeding guilds are indicative of a healthy marine food web.	Species composition (Mean Maximum Length indicator) within fish guilds (OSPAR)	Bottom trawl and beam trawl surveys for fish.
		Selected plankton lifeforms pairs (e.g. large vs small zooplankton) (OSPAR)	Continuous Plankton Recorder (CPR), fixed point sampling and Research Vessel sampling
Trophic Guild balance	The balance of abundance between representative feeding guilds is indicative of a healthy food web.	Relative biomass of feeding guilds (including piscivores, benthivores, and planktivores)	Bottom trawl and beam trawl surveys for fish. Acoustic surveys for pelagic fish. SCANS and. SSMP.
		Selected plankton lifeforms pairs (e.g. copepods vs diatoms) (OSPAR)	CPR, fixed point sampling

Size distribution	The size structure of fish communities is indicative of a healthy marine food web.	Fish community size structure: Typical Length within guilds and communities (OSPAR) and Large Fish Index overall (OSPAR)	Bottom trawl and beam trawl surveys for fish
Productivity	Productivity of each of the representative feeding guilds, characterised by key species, is indicative of a healthy marine food web	Adaptation of existing OSPAR indicators of: grey seal pup production, kittiwake breeding success, marine bird breeding success/failure	Bottom trawl and beam trawl surveys for fish
		Possible indicators of larval/juvenile abundance of keystone fish species (e.g. sandeels and herring/sprat)	Dredge surveys for sandeels off the Firth of Forth and around Turbot bank Irish Sea young fish MIK net survey (fish and plankton) CPR survey for fish larvae (sandeel and clupeids)
Monitoring programme details			

Fisheries surveys	A range of trawl, net, dredge and acoustic surveys for adult and juvenile fish and eggs with additional oceanographic, plankton, seabed sampling and bird or mammal sightings data.
Plankton surveys	Plankton surveys include the use of the Continuous Plankton Recorder, point sampling, research vessel data collection and dedicated larval fish surveys.
Seal population monitoring	The UK seal monitoring programme is run by the Sea Mammal Research Unit (SMRU) at the University of St Andrews and is funded by Natural Environment Research Council (NERC). SMRU undertakes systematic monitoring of a limited number of sites, covering the major breeding colonies for grey seals. Monitoring in other areas is undertaken by a variety of groups with information collated by SMRU. The results are published annually through the Special Committee on Seals. 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. In Northern Ireland, DAERA monitors breeding populations of Harbour and Grey seal at sites for which they are a designated feature (by land and sea). There is potential for aerial surveys to be carried out every two to three years.
Seabird monitoring programme	The SMP is a partnership of 19 organisations, led by the Joint Nature Conservation Committee (JNCC). It provides year to year trends in abundance and breeding success of seabirds at a sample of breeding colonies in the UK, Isle of Man, Channel Isles and the Republic of Ireland. Monitoring is conducted by volunteers and professionals. It is also used to monitor protected sites, including Special Protection Areas (SPAs).
Volunteer Seabirds at sea monitoring programme (VSAS) (pilot)	JNCC are leading the VSAS pilot project to assess whether information on the distribution and abundance of seabirds at sea could be collected using volunteers on ‘ships of opportunity’ (ferries, research cruises, etc.).
Small Cetaceans in European Atlantic waters	SCANS is an approximately decadal multilateral (ship and aerial) survey conducted in northern European waters to assess cetacean abundance. SCANS was initiated in 1994 and continued in 2005

and the North Sea (SCANS) surveys	(SCANS-II) and 2007 (Cetacean Offshore Distribution and Abundance in the European Atlantic, CODA), with the most recent survey taking place in 2016 (SCANS-III).

Regional Cooperation

Many fisheries surveys are international and coordinated by ICES. Beyond fish data, trawl and acoustic surveys in particular also serve to provide data on plankton, benthos, habitats, oceanography, and seabird and mammal sightings. These have facilitated the development of indicators across two ICES working groups (the Working Group on Biodiversity Science and the Working Group on Ecosystem Effects of Fishing Activities) and the OSPAR Intersessional Correspondence Group on the Coordination of Biodiversity Assessment and Monitoring.

Food web monitoring also create opportunities for gathering data on species of special interest. For example, underwater televisions (UWTV) surveys have routinely recorded sea pens, a benthic invertebrate species, since 2012, following a special request from OSPAR in 2011. Currently, surveys routinely record the presence of trawl marks and sea pen species (*Virgularia mirabilis*, *Pennatula phosphorea*, and *Funiculina quadrangularis*)[19].

Developments in monitoring since 2014

Routine monitoring has continued with the addition/extension of new surveys:

English Ecosystem Survey of the Celtic Sea and Western Channel (beam plus grab sampling)

English Pelagic Ecosystem (Acoustic) Survey for the Celtic Sea/Western Channel

Northern Ireland Marine Ecosystem Survey

Issues and opportunities

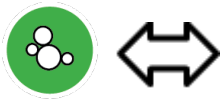
Several knowledge gaps exist and indicator development needs to be carried out to achieve a more robust assessment of whether marine food webs are adversely affected by human activities. These knowledge gaps include the extent of changes in predator-prey interactions and the importance of climatically driven changes impacting plankton.

Incorporating other types of data such as juvenile MIK net surveys (larvae and jellyfish) and plankton research vessel data collection would also strengthen and improve confidence in our assessments of food webs. As the food web extends well beyond UK seas, our

[19] ICES 2018 https://doi.org/10.17895/ices.pub.4370

intention is to address these issues through OSPAR and build on the recent research outcomes from the Defra funded Marine Environmental Research Programme. This will improve our understanding of the ecosystem processes that underpin the marine food web, how they are responding to environmental change and management scenarios for improving their status. As our monitoring improves for ecosystem components including birds and mammals, the relationships between trophic levels will become clearer. By using refined ecosystem models, we will be able to evaluate food web status under different environmental and management scenarios.

<table>
<tr><th colspan="4">EUTROPHICATION D5</th></tr>
<tr><td>Overall summary</td><td colspan="3">We propose that the monitoring of eutrophication will be carried out largely by existing monitoring programmes.

Data on nutrient concentrations, chlorophyll, and dissolved oxygen are collected and the results integrated according to the requirements of the River Basin Management Plan (RBMP) in coastal waters and the OSPAR Comprehensive Procedure for the assessment of eutrophication status in marine waters.</td></tr>
<tr><td>Environmental Status in 2018</td><td colspan="2">  </td><td>The UK had largely achieved its aim of Good Environmental Status (GES) for eutrophication. A small number of eutrophication problems remained in coastal and estuarine waters, representing 0.03% of the total UK Exclusive Economic Zone, and 0.41% of estuarine and coastal waters.</td></tr>
<tr><td>High level objective for GES</td><td colspan="3">Human-induced eutrophication is minimised in UK marine waters.</td></tr>
<tr><td colspan="4">How progress towards GES is measured using monitoring, indicators and targets.</td></tr>
<tr><th>Criteria</th><th>Target</th><th>Indicators</th><th>Monitoring programmes</th></tr>
<tr><td>Nutrient concentrations</td><td>Nutrient concentrations are below the levels</td><td>Nutrient concentrations of Dissolved</td><td>Integrated eutrophication monitoring programme nutrient concentrations</td></tr>
</table>

	which could lead to harmful eutrophication effects.	Inorganic Nitrogen and Dissolved Inorganic Phosphorus	
Chlorophyll concentrations	Chlorophyll a concentrations are below levels which could lead to harmful eutrophication effects.	Chlorophyll concentrations (OSPAR)	Integrated eutrophication monitoring programme chlorophyll concentrations
Dissolved oxygen content	Dissolved oxygen content in coastal waters are above levels which could lead to harmful eutrophication effects.	Concentrations of dissolved oxygen	Integrated eutrophication monitoring programme dissolved oxygen content
Operational targets	We will work with other countries to further refine the OSPAR Common Procedure and develop threshold values which take account of regional or sub-regional specificities if this proves to be necessary. We will work with other countries to develop remote sensing assessments of chlorophyll to provide a real-time picture of nutrient enrichment.		
Monitoring programme details			
Integrated eutrophication monitoring programme	The integrated programme for the assessment of eutrophication status in UK coastal and marine waters measures 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. This uses the ongoing programme set up to assess eutrophication status in coastal waters under the RBMPs, and will be supplemented by a more limited programme using the OSPAR Common Procedure for the assessment of the Eutrophication Status of marine waters of the North East Atlantic (COMP) for offshore waters. The indicator results will be integrated according to the rules set out in the OSPAR COMP.		

	The programme will also check that there is no deterioration in the nutrient status of areas potentially at risk, and will check that nutrient concentrations are falling in existing eutrophication problem areas identified in the updated Marine Strategy Part One integrated assessment of eutrophication status. These identified 'problem areas' are located in a small number of coastal embayments and estuaries.

Regional Cooperation

The UK is cooperating with other OSPAR countries to further enhance the OSPAR common assessment procedure and to explore the development of a common assessment methodology across the OSPAR Convention Area where national results for nutrients, chlorophyll and dissolved oxygen are assessed against common, but regionally specific standards.

Developments in monitoring since 2014

Monitoring programmes have been adjusted to take account of developments in indicators, methodologies and assessment procedures that have been agreed with other OSPAR countries and with EU Member States through inter-calibration processes undertaken through the RBMP Common Implementation Strategy. The methodologies were tested and applied in the OSPAR Intermediate Assessment 2017 and the updated assessment of eutrophication status in UK waters set out in the updated UK Marine Strategy part One.

The UK has also engaged in the Joint Monitoring Programme of the Eutrophication of the North Sea with Satellite data (JMP-EUNOSAT) programme which has been examining the suitability of modelling and the use of remote sensing data for eutrophication assessment in the Greater North Sea. Further validation work is being considered before it is incorporated into routine monitoring.

Issues and opportunities

Preliminary results from Scottish waters indicate that further work is required to improve the reliability in satellite monitoring for chlorophyll levels in UK waters, as part of the JMP-EUNOSAT project.

Changes in prevailing conditions, such as temperature and turbidity, might affect dissolved oxygen concentrations and other parameters. Additional investigation to understand the potential impact of prevailing conditions in the context of changes to trophic status caused by nutrient loads would be of benefit. Improving our knowledge on the effectiveness of our

measures for returning eutrophic waters to more natural conditions would help focus our resources where we can make the most positive change in the future.

Increased rainfall caused by climate change can increase the loads of nutrients entering the marine environment from rivers and we will monitor any trends through the OSPAR Riverine Inputs and Direct Discharges Programme.

Increasing sea temperature can influence the rate of growth of phytoplankton causing blooms to proliferate and affect the oxygen concentration our seas and we will check this through our chlorophyll and oxygen monitoring programmes.

In addition, we need a better understanding the linkages between different rates of nutrient enrichment, algae response and undesirable balance in our estuarine and coastal environment to develop assessment criteria that measure these types of changes and contribute to greater understanding of risk.

CONTAMINANTS D8		
Overall summary	We propose that the monitoring of contaminants will be carried out by a number of existing monitoring programmes. Data on concentrations, biological effects, and significant pollution effects are collected by the following programmes: i) concentrations of contaminants in water, sediments and biota (fish and shellfish) in coastal and marine waters in areas considered to be at risk; ii) biological effects of contaminants in biota in coastal and marine waters; and iii) the occurrence and extent of acute pollution effects arising from spills of oil or chemicals likely to have significant effects.	
Environmental Status in 2018		The UK had largely achieved its aim of Good Environmental Status (GES) for contaminants. Concentration of hazardous substances and their biological effects were generally meeting agreed target thresholds. Highly persistent legacy chemicals were the cause of the few failures, mainly in coastal waters close to polluted

		sources.
High level objective for GES	Concentrations of specified contaminants in water, sediment or marine biota, and their effects, are lower than thresholds that cause harm to sea life, and are not increasing.	
How progress towards GES is measured using monitoring, indicators and targets.		
Criteria	**Target**	**Indicators**	**Monitoring programmes**
Concentrations of contaminants in coastal and territorial waters	Concentrations of contaminants measured in water, sediment or marine biota comply with appropriate threshold values.	Metals in biota and sediment (OSPAR); Polychlorinated Biphenyls (PCBs) in biota and sediment (OSPAR); Polycyclic Aromatic Hydrocarbons (PAH) in biota and sediment (OSPAR); Polybrominated Diphenyl Ether (PBDEs) in biota and sediment (OSPAR); Radionuclides; Metal inputs from water and air; Contaminants in coastal waters;	Concentrations of contaminants in water, sediments and biota in coastal and marine waters including areas considered to be at risk.

		River basin specific pollutants	
Health of species and condition of habitats	Biological or ecological effects on sea life due to contaminants are below thresholds agreed by OSPAR.	Imposex in dog whelks; Micronucleus test; Ethoxyresorufin- O -deethylase (EROD) activity; Bile metabolite; Liver neoplasm; Fish disease.	Biological effects programme
Impact of significant acute pollution events on species and habitats	The adverse effects of significant acute pollution events on the health of species and on the condition of habitats (such as their species composition and relative abundance) are minimised and, where possible, eliminated.	Number and size of spills	Based on spill reports and ad hoc follow up, including appropriate monitoring where justified, depending on type and significance of the spill
Operational targets	Work nationally and with other countries to establish common threshold values for contaminants and their effects where these pose risks to marine life. Work nationally and with other countries to identify chemicals of emerging concern which pose risks to marine life and develop common lists and management actions by 2022. Work nationally and with other countries to investigate the cumulative effects of combinations of contaminants on sea life populations and take appropriate actions. Refine UK emergency response procedures to ensure that risks from acute pollution events do not significantly impact marine biota or		

	habitats.
Monitoring programme details	
Concentrations of contaminants in water, 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 agreed standards. It will integrate the monitoring of contaminants used to implement the River Basement Management Plans (RBMPs) and other regulations 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. 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.
Biological effects	The programme monitors for biological effects of contaminants. These currently include: i) English and Scottish risk-based programmes of biological effects monitoring of fish 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.
Occurrence and extent of acute pollution effects arising from spills of oil or chemicals likely to have significant 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 deploys appropriate monitoring programmes using the associated PREMIAM Guidelines[20] 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.

[20] https://www.cefas.co.uk/premiam/guidelines/

Regional Cooperation

There has been a concerted effort to coordinate UK monitoring programmes on contaminants with those of other countries sharing the North East Atlantic, to ensure that the assessments carried out are comparable, where possible and common threshold values are used and press for the inclusion of emerging chemicals of concern to be adopted in OSPAR's Coordinated Environment Monitoring Programme.

Going forward, it will be necessary to work together with other countries to identify emerging contaminants of concern that may have significant impacts on sea life, and to continue to investigate the cumulative effects of combinations of contaminants on sea life populations.

Developments in monitoring since 2014

Monitoring programmes for contaminants have remained largely unchanged since 2014, and data collected in nearly all the monitoring programmes listed above have been used for the OSPAR Intermediate Assessment 2017 and the assessments used for the updated Marine Strategy Part One. Maintaining this consistent monitoring programme has enabled us to check the indicators' fitness for purpose, build up comparable data and ensure the confidence that can be assigned to the results together with other countries of the North East Atlantic. It is now possible to carry out regular annual assessments for each substance and the reduction trend over a number of years, and these can now be accessed on-line.

Issues and opportunities

Further integration and development of biological effects measurements to better understand the impact of chemicals at individual, and population levels should be pursued. This should include integration of chemical monitoring in cetaceans to existing assessments to better understand the bioaccumulation of persistent chemicals.

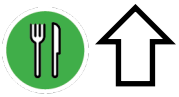
It is necessary to identify and assess the potential impacts of emerging substances using a source to sea approach.

An improved understanding of the risks that chemical mixtures have, and how impacts from chemicals in combination with other pressures such as physical and nutrient impacts act, would help ensure that measures are appropriate and effective.

Projected changes in the hydrological cycle and storm climate altering the spatial and temporal distribution of rainfall or remobilisation of sediments could affect the inputs of contaminants into the marine environment, and we will monitor any trends through the OSPAR Riverine Inputs and Direct Discharges and Atmospheric Monitoring Programme.

Secondary pollution from re-suspended material and from sources outside the UK Marine Strategy Area are now the major sources of airborne pollution, and we will monitor these inputs through the OSPAR Atmospheric Monitoring Programme.

Lowered pH can enhance the toxicity of some heavy metals for marine organisms and further research will be necessary to determine the possible risks, and whether additional measures will be needed.

CONTAMINANTS IN SEAFOOD D9			
Overall summary	Current monitoring enables us to determine that there is a high level of compliance with agreed safety levels. We propose that further ad hoc surveys be used to check this status.		
Environmental Status in 2018		The UK achieved its aim of Good Environmental Status (GES) for contaminants in seafood. There was a high level of compliance with agreed safety levels.	
High level objective for GES	Concentrations of specified contaminants in fish and other seafood caught or harvested for human consumption in UK seas do not exceed agreed safety levels set in Regulation (EC) No 1881/2006 as amended.		
How progress towards GES is measured using monitoring, indicators and targets.			
Criteria	**Target**	**Indicators**	**Monitoring programmes**
Safe levels of contaminants in seafood	For contaminants where regulatory levels have been set, and a risk assessment has indicated that concentrations in some commonly eaten seafood may be of concern to the public if they exceed current precautionary	Contaminant concentrations in seafood	Surveys of contaminants in seafood in commercial fishing grounds

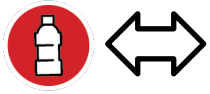
	advice to restrict consumption of certain higher risk species, there should be a high rate of compliance based on relevant surveys and including samples originating from commercial fishing grounds in the Greater North Sea and the Celtic Seas. Concentrations of contaminants measured in water, sediment or marine biota comply with appropriate threshold values.		
Operational targets	The UK will work with other countries at regional level to establish whether risks posed by additional contaminants that are not included in Regulation (EC) No 1881/2006 are sufficient to include them in UK surveys.		
Monitoring programme details			
Surveys of contaminants in seafood from commercial fishing grounds in UK seas	The Food Standards Agency, Food Standards Scotland and the Environment Agency will consider further ad hoc surveys to determine whether contaminant levels in seafood taken from commercial fishing grounds in the Greater North Sea and Celtic Seas remain below current or proposed safety levels. These will include 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 to human health within UK or international programmes.		
Regional Cooperation			
The UK will work with other countries at regional level through the relevant expert groups under the Standing Committee on Plants Animals and Foods to ensure that risks from contaminants that might pose significant risks to humans are taken into consideration.			
Developments in monitoring since 2014			

Further measurements of contaminant concentrations in fish and shellfish from fishing grounds in the Celtic Seas and the Greater North Sea have confirmed the results from the UK Initial Assessment in 2012, showing that there has been a high level of compliance with the standards set in European food legislation. Also a number of additional substances not currently regulated under regulation 1881/2006 were covered in the original survey and some more recent testing, including brominated flame retardants, brominated and mixed halogenated dioxins and biphenyls, perfluorinated alkyl substances and polychlorinated naphthalenes, as well as some legacy pesticides and heavy metals.

Lowered pH may change the availability of some heavy metals for marine organisms and further research will be necessary to determine the possible risks, and whether additional measures will be needed.

Issues and opportunities

As new chemicals or groups of chemicals of potential concern to sea life and human health are continually being identified (for example perfluoroalkyl substances, PFAS) we will prioritise these for future investigation of their potential risks and inclusion in monitoring programmes subject to resource availability.

MARINE LITTER D10		
Overall summary	We propose that the monitoring of marine litter will be carried out by existing programmes. Data on marine litter on beaches, on the seafloor and in the water column are monitored by the following monitoring programmes: i) OSPAR Beach Litter Monitoring Programme ii) Seafloor Litter Monitoring Programme iii) OSPAR common indicator Fulmar Programme	
Current Environmental Status in 2018		The UK had not yet achieved its aim of GES for litter. Beach litter levels in the Celtic Seas had remained largely stable since the assessment in 2012, whilst beach litter levels in the Greater North Sea had slightly increased.

High level objective for GES	The amount of litter and its degradation products on coastlines and in the marine environment is reducing and levels do not pose a significant risk to the environment and marine life.		
How progress towards GES is measured using monitoring, indicators and targets.			
Criteria	**Target**	**Indicators**	**Monitoring programmes**
Presence of Litter (beaches)	A decrease in the total amount of the most common categories of litter found on surveyed beaches.	Beach litter surveys (OSPAR)	OSPAR Beach Litter Monitoring Programme
Presence of Litter (Seabed)	A decrease in the number of items of litter on the seabed.	Seafloor International Benthic Trawl Surveys common indicator (OSPAR)	OSPAR Seafloor Litter Monitoring Programme
Presence of floating litter	A downward trend in the number of northern fulmars with more than 0.1 g of plastic particles in their stomach.	Floating litter using plastic in fulmar stomachs (OSPAR)	OSPAR common indicator Fulmar Programme
Presence of micro-litter	Develop an appropriate indicator to measure micro-litter in the marine environment.	Microplastics in marine sediment	Under development - methodology needs to be developed and agreed in OSPAR
Operational targets	We will work nationally and with other countries in OSPAR to:		

	a) establish the feasibility of setting appropriate reduction targets and/or threshold values for litter on beaches, on the seafloor, sea surface, and micro plastics, taking into account regional or sub-regional specificities; b) develop an indicator for micro-litter in sediment; c) establish, if practicable, whether the amount of litter and micro-litter accumulated by marine animals adversely affects the health of the species concerned; and d) develop appropriate measures to reduce litter types harmful to the marine environment.
Monitoring programme details	
OSPAR Beach Litter Monitoring Programme	This monitoring programme is well developed, comprising of beach surveys carried out on a quarterly basis. OSPAR have produced an agreed set of protocols for this programme. In England, Wales and Scotland the programme is administered by the Marine Conservation Society (MCS), who have collected 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 UK Marine Strategy monitoring programme is based on the data for a sub-set of OSPAR-designated beaches.
Seafloor Litter Monitoring Programme	Data collected from trawl surveys, typically carried out for fish stock assessments, are used to monitor the amount of litter on the seafloor. The UK benthic litter monitoring programme will be based on the continuation of existing surveys in England, Wales, Scotland and Northern Ireland and will take into account litter accumulation zones.
OSPAR Fulmar Programme	Dead fulmars are collected opportunistically and the number of plastic particles in their stomachs is analysed by IMARES in the Netherlands who provide annual reports to the UK. 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 over the coming five years.
Candidate programme for	The UK is leading work in OSPAR with a view to developing a common indicator and associated monitoring programme for

microplastics in sediment	microplastics in marine sediment. Current projections are that this may be operational in 2021/22.

Regional Cooperation

On a regional scale, we work with OSPAR to carry out assessments of marine litter and to implement the OSPAR Regional Action Plan for the Prevention and Management of Marine Litter in the North-East Atlantic and to prepare a regional assessment on marine litter for the OSPAR Quality Status Report in 2023.

We are working nationally and with other countries in OSPAR to develop an indicator and associated monitoring programme for microplastics in sediment. We will also continue research which aims to improve cross-border capabilities to monitor, prevent and remove marine litter in the North-East Atlantic area.

Seafloor litter monitoring methods have not yet been fully developed and standardised and we aim to work within OSPAR to develop these.

Developments in monitoring since 2014

Since 2014, data collected in the operational monitoring programmes for the indicators listed above have been used to contribute to the OSPAR Intermediate Assessment 2017 and the assessments used for the updated UK Marine Strategy Part One. This has enabled us to check their fitness for purpose and the confidence that can be assigned to the associated results together with other countries of the North East Atlantic.

Issues and opportunities

The need for an indicator to assess the level on microplastics in the marine environment is recognised and the UK is participating in steps being taken in OSPAR to develop this.

Evidence does not currently indicate that climate change will directly affect marine litter or its impact on biota but its influence on water currents, weather conditions and prevailing wind conditions could have a significant influence on the deposition and retention of litter on beaches and therefore litter abundance.

UNDERWATER NOISE D11			
Overall summary	Since 2015 the Marine Noise Registry (MNR) has been recording data on impulsive sound sources. Ambient noise is measured at monitoring locations using autonomous underwater recorders moored to the seabed. These monitoring programmes will continue.		
Current Environmental Status in 2018		The achievement of Good Environmental Status (GES) for underwater noise in the UK was uncertain. Research and monitoring programmes established since 2012 provided an improved understanding of the levels of impulsive and continuous noise pollution in UK waters.	
High level objective for GES	Loud, low and mid frequency impulsive sounds and continuous low frequency sounds introduced into the marine environment through human activities are managed to the extent that they do not have adverse effects on marine ecosystems and animals at the population level.		
How progress towards GES is measured using monitoring, indicators and targets.			
Criteria	**Target**	**Indicators**	**Monitoring programmes**
Safe levels of anthropogenic impulsive sound.	Levels of anthropogenic impulsive sound sources do not exceed levels that adversely affect populations of marine animals.	Distribution and timing of man-made impulsive sound sources. Impulsive noise impact indicator is under development (OSPAR).	MNR
Safe levels of anthropogenic	Levels of anthropogenic continuous low-frequency sound	Levels of ambient noise mapped using acoustic modelling	Ambient noise monitoring programme

continuous low frequency sound	do not exceed levels that adversely affect populations of marine animals.	techniques and validated using observation stations.	
Monitoring programme details			
Marine Noise Registry (MNR)	Information about impulsive sound sources is submitted to the Marine Noise Registry from mandatory and voluntary contributors. The MNR was designed to gather data in order to monitor cumulative pressure, assess the potential for disturbance impacts, understand the distribution of impulsive sound, and if needed, inform management activities.		
Ambient noise monitoring programme	Underwater noise is monitored at monitoring locations around the UK: 12 locations in the North Sea (ten locations in the Northern North Sea by Marine Scotland Science, and two locations in the Southern North Sea by Cefas), two locations in the Celtic Seas (Rame Head and Puffin Island, coordinated by Cefas), and one location in the Irish Sea (Carlingford, coordinated by the Joint framework for Ocean Noise in the Atlantic Sea, JONAS) using autonomous underwater recorders moored to the seabed.		
Regional Programmes	The Collaborative Oceanography and Monitoring for Protected Species (COMPASS[21]) helps to build an understanding of how cetaceans use an area of sea and how they may be impacted by or respond to pressure from human activities. Through a network of oceanographic and acoustic moorings across the regional seas of the Republic of Ireland, Northern Ireland and West Scotland, COMPASS provides effective cross-border monitoring of cetaceans. COMPASS is collaborating with the JONAS project to examine the effects of noise and streamline ocean noise monitoring.		
Regional Cooperation			
The UK works with OSPAR Contracting Parties on two proposals for joint noise monitoring, one covering the Greater North Sea (the Joint Monitoring Programme for Ambient Noise North Seas, JOMOPANS), the other covering the Atlantic Area (JONAS).			

[21] See footnote 8

The UK has been a key player in development, monitoring and assessment of the OSPAR impulsive noise common indicator, and the UK data were used in the OSPAR Intermediate Assessment 2017.

Developments in monitoring since 2014

The MNR collects information on the distribution and duration of impulsive sound in UK waters. It contains data recorded since 2015 and is operational on an ongoing basis. This monitoring will be used to establish a baseline for impulsive sound in UK seas, allowing for assessment of patterns and trends.

The monitoring programme on ambient noise has provided baseline levels for each of the monitoring locations and is being used to validate spatial models of continuous anthropogenic sound in UK waters.

The COMPASS project was initiated in 2017, establishing a network of oceanographic and acoustic moorings within and adjacent to cross-border marine protected areas, including extensive deployment of passive acoustic monitoring arrays in the Irish Sea.

The JONAS project was established and has been investigating cumulative noise impacts, developing noise maps and large-scale noise risk mapping, and tools and methodologies for noise monitoring.

Cefas have published the first UK noise assessment, the work that is being carried out across the UK will contribute to these future assessments.

Issues and opportunities

More data on sound properties, such as sound pressure level and frequency, are needed in order to better understand their impacts on marine wildlife.

Some research points to a possible link between ocean pH and sound transmission, but detailed acoustic studies suggest any direct change associated with projections of ocean acidification will be very limited. Research also shows that warmer water temperatures lead to poorer sound propagation and the implications of this for sea life are unclear.

Section 3: Monitoring programmes for prevailing conditions used to support the assessment of Good Environmental Status (GES)

This section sets out details of the monitoring programmes for each of the ocean processes (ocean acidification, temperature, salinity, turbidity and waves) which exist for other purposes but are used to support the monitoring of Descriptor 7, “hydrographical conditions”, that may be required to support assessments used:

a. under the regulatory assessment processes associated with Descriptor 7 (e.g. Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA); and
b. to determine whether the quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions.

No monitoring programme, however, has been put forward specifically for Descriptor 7. This is because, currently, there are no significant broad scale alterations of hydrographical conditions affecting ecosystems in UK marine waters beyond those currently covered by provisions of the River Basin Management Programme (RBMP), which has its own dedicated arrangements.

As prevailing conditions change in response to changing climate, we expect there to be an effect on some of the marine indicators of ecosystem dynamics and pressures on our seas. For the next assessment of UK seas in 2024, we aim to better integrate the prevailing conditions information collected in the monitoring programmes set out below into our indicator assessments.

For each monitoring programme we set out:

Environmental status	This covers what is known about the status of the parameter as reported in the Marine Strategy Part One 2019.
Rationale for monitoring	This sets out the main reasons for monitoring and how it helps our assessments of Good Environmental Status (GES)

Monitoring programmes	This sets out the main monitoring programmes that are underway
Regional cooperation	This describes the various national, European and international programmes and organisations in which the scientists work together to coordinate and improve knowledge on methodology and collaboration
Gaps and issues	This sets out where further work might be needed to get more robust measurements and status assessments

pH & OCEAN ACIDIFICATION	
Environmental Status in 2018	Between 2010 and 2015, the evidence of ocean acidification for UK waters is consistent with the global trend, which shows the pH of seawater is decreasing. There is strong seasonal, inter-annual, depth and spatial variability in pH across UK waters.
Rationale for pH & ocean acidification monitoring	Coordinated long-term ocean acidification (OA) monitoring is essential to assess variability and trends in the ocean carbon system and support assessment of the risks to and impacts of pH changes on marine ecosystems and services, so that appropriate measures can be taken.
Monitoring programmes that contribute to assessment of ocean acidification in UK seas.	
Monitoring Programmes	Scottish Coastal Observatory sites at Stonehaven and at Loch Ewe Smart Buoy programme (OA not ongoing) NE Atlantic Hub for the Global Ocean Acidification Observing Network UK Integrated Marine Observing Network programme Continuous Plankton Recorder (impacts & future technical development) Northern Ireland Coastal & Oceanographic Mooring Network
Regional Cooperation	Cooperation between countries at European and global level on pH monitoring takes place in the following networks and organisations: The Global Ocean Acidification Network; and The OSPAR Intersessional Correspondence Group on

	Ocean Acidification (ICG-OA) where countries pool monitoring information at North East Atlantic scale.
Issues and opportunities	There are limited datasets available to contribute to the assessment of local conditions and long-term changes. New sensors and platforms (like gliders and profiling floats) are under consideration for increasing the cost-effectiveness and spatial coverage of UK ocean acidification measurements. Most ocean acidification measurements are near surface leading to a knowledge gap in understanding change in seasonally stratified areas and at the sea-bed in general.

TEMPERATURE	
Environmental Status in 2018	The trend of sea surface temperature in UK waters reflects the warming reported in the Initial Assessment in 2012. A series of cold winters (2011 – 2013) resulted in a slight decrease to this trend, but since 2014 seas have been warmer again.
Rationale for sea temperature monitoring	Sea temperature is a major driver of marine ecosystems and one of the key factors affecting the distribution, physiology and ecology of marine species and habitats. Knowledge of how it is changing is important for how these are managed and protected. Temperature measurements also benefit a wide spectrum of operational applications, including climate and seasonal monitoring and forecasting.
Monitoring programmes that contribute to assessment of temperature in UK seas.	
Monitoring programmes	Scottish Coastal Observatory Marine Scotland Offshore Long -Term Monitoring Smartbuoy International Council for the Exploration of the Seas (ICES) International Bottom Trawl Survey UK - Integrated Marine Observing Network Northern Ireland Coastal & Oceanographic Mooring Network

Regional cooperation	Cooperation between countries at European and global level has led to the production of the following reports, programmes and surveys covering sea temperature: ICES Report on Ocean Climate, Copernicus Ocean Status Report, European Global Ocean Observing System, Hydrographic surveys (International Oceanographic Commission “Go-SHIP” initiative), EU Interreg & H2020 programmes, Argo drifting float programme
Issues and opportunities	Our understanding of the inter-annual, decadal and long-term variability of sea temperature is based on long-time-series data which are missing for some places or broken in others. We hope to improve our assessments by combining models with historical observations to provide ‘re-analyses’ for future assessments.

SALINITY	
Environmental Status in 2018	The salinity of the upper ocean to the west and north of the UK has decreased sharply from 2011. This probably reflects a change in balance between the subtropical (salty) seawater versus subpolar (fresh) seawater in the North-East Atlantic. Lower salinity was also observed in the northern North Sea between 2013 and 2015.
Rationale for salinity monitoring	Salinity is a key factor determining the density of ocean water. Understanding how it is changing is essential for understanding its impact on ocean circulation, the Earth's water cycle, marine ecosystems and climate change.
Monitoring programmes that contribute to assessment of salinity in UK seas.	
Monitoring programmes	Scottish Coastal Observatory Marine Scotland Offshore Long-Term Monitoring Smartbuoy International Council for the Exploration of the Seas International Bottom Trawl Survey UK Integrated Marine Observing Network Northern Ireland Coastal & Oceanographic Mooring Network

Regional cooperation	Cooperation between countries at European and global level has led to the production of the following reports, programmes and surveys covering salinity: - International Council for the Exploration of the Seas (ICES) Report on Ocean Climate, - Copernicus Ocean Status Report, - European Global Ocean Observing System, - Hydrographic surveys (International Oceanographic Commission “Go-SHIP” initiative) - EU Interreg & Horizon 2020 programmes, - Argo drifting float programme
Issues and opportunities	Salinity data are generally sparse in comparison to temperature data and so confidence in the assessments of long-term trends and spatial variability is lower. Some long-term series of observations are no longer available but additional new sources of information are becoming available, e.g. through using autonomous platforms.

TURBIDITY	
Environmental Status in 2018	Satellite observations over 1998-2015 show significant increases in annual average surface suspended particulate matter in 5 out of 10 UK marine regions.
Rationale for turbidity monitoring	The light climate or suspended particulate matter of the marine environment can influence primary production; air-sea heat transfer; sedimentation rates and biogeochemical transfers from the water column to the seabed; productivity of the benthos; and oxygen levels in bottom waters. It is therefore essential to have information on how it is changing.
Monitoring programmes that contribute to assessment of turbidity in UK seas.	
Monitoring programmes	Scottish Coastal Observatory Smartbuoy & Cefas Monitoring Cruise programmes UK Integrated Marine Observing Network Northern Ireland Coastal & Oceanographic Mooring Network
Regional Cooperation	Cooperation between counties at European level to provide turbidity information takes place through the Copernicus Marine Environment Monitoring Service European Earth Observation Programme and through ICES in the compiling of historic data sets.

Issues and opportunities	Identifying causes of the trends in suspended particulate matter concentration needs further research. There is a need to improve integration of in situ observations with remote sensing estimates, particularly matching the observations to the location and timing of satellite overpasses. Better coverage of sub-surface suspended particulate matter and turbidity would add information that is beyond the reach of satellite sensors.

WAVES	
Environmental Status in 2018	Whilst local studies have been carried out, no systematic UK wide assessments of changes in significant wave height, wave period or wave direction have been undertaken for the period 2011-2015.
Rationale for wave monitoring	Knowledge of the wave regime and how it is changing is important in developing shoreline defence schemes, large infrastructure projects and for flood and coastal management.
Monitoring programmes that contribute to assessment of waves in UK seas.	

Monitoring programmes	The UK WaveNet Programme, coordinated by the Centre for Environment, Fisheries & Aquaculture Science (Cefas) provides a strategic wave network using a network of wave buoys located in areas at risk from flooding. The SIMORC (System of Industry Metocean data for the Offshore and Research Communities) makes available historic wave data from Shell, Total and BP (International Association of Oil and Gas Producers). Marine Data Exchange for Renewables - The Crown Estate stores, manages and disseminates offshore survey data provided by offshore renewable and marine aggregates customers. Operational Oceanography Special Interest Group & the UK Integrated Marine Observation Network (UK-IMON) bring together many of the organizations making wave observations and forecasts. Copernicus Significant Wave Height from Jason-3 and Sentinel-3A satellite altimeter data. Regional Coastal Monitoring programmes.
Regional cooperation	Cooperation between countries and scientists at European and global level on addressing waves takes place through the following programmes and organisations: - the Copernicus programme - the European Global Ocean Observation System - the European Marine Observation and Data Network

Issues and opportunities	While waves are well observed, modelled and monitored, analysis at the larger spatial and longer temporal scales needed for UK Marine Strategy purposes may need further development.