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UK Marine Strategy Part One:

Updated assessment and Good Environmental Status

April 2026

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Executive Summary

Tide swept circalittoral rocky reef community dominated by Jewel anemones (*Corynactis viridis*) The Manacles MCZ

Overall conclusions on the achievement of Good Environmental Status

We have made some progress toward achieving good environmental status (GES) since 2012 and, whilst there are some encouraging signs of recovery (for example commercial fisheries, grey seals and marine litter), it is clear that more remains to be done. Our collective assessments show that:

There remains a mixed picture for marine ecosystems

There is a mixed picture for marine mammals: GES has been achieved for grey seals, showing stable or increasing populations, but harbour seals are declining in specific areas. The status of cetacean populations is less positive overall, with bycatch seen as a key contributor to their 'not met' status across the Greater North Sea and Celtic Seas.

Some sensitive fish species are recovering with respect to their status in 2019, but overall, the species-composition and size-structure of demersal fish communities has deteriorated in the Greater North Sea and Celtic Seas regions. Their status is echoed in our assessment of food webs, where the picture across all indicators is one of overall, and occasionally widespread, decline.

Marine birds remain widespread in their distribution but comparison between regions shows that the abundance of non-breeding marine birds has declined, dropping below their GES target in the Greater North Sea, which was met in 2019. Celtic seas remain below target for the same indicator, as they were in 2019. Breeding success for both regions has also declined. Measures to remove invasive mammals on important island marine bird colonies are proving successful, however, with this indicator meeting GES thresholds in both regions.

Whilst benthic habitats overall are comparable to 2019 and have not met GES overall, two thirds of broad-scale benthic habitats in the Celtic Seas have now met GES. It is important to note that measures recently introduced to improve protections for benthic habitats will take time to achieve their long-term aims.

Pressures on our seas remain high

Non-indigenous species (NIS) are yet to achieve GES, and some NIS are well established in UK waters. Commercial fish and shellfish fisheries continue to improve but have still only partially met GES. A range of policies and initiatives are underway and in development as part of the delivery of national fisheries management strategies and the UK Joint Fisheries Statement.

Eutrophication remains at GES. Bottom water dissolved oxygen concentrations remain at GES for the UK river plumes and coastal assessment areas, but the overall dissolved oxygen status, however, is trending away from GES (decreasing oxygen concentrations, a negative effect). We did not conduct an assessment of hydrographical conditions but are asserting that it remains at GES based on the same premise proposed in the previous UKMS Part 1 assessment in 2019.

The way we assess chemicals and other contaminants has changed, due to the threshold for mercury being raised to more closely reflect the environmental conditions at sea. By raising this threshold, we are ensuring we remain aligned with the European Commission and other international treaties on this issue. Going forward, we will continue work with other countries through OSPAR to check that emerging chemicals of concern are screened, and possible risks evaluated.

We completed an assessment of contaminants in seafood for shellfish, which remain at GES, but the status of the descriptor overall is uncertain due to a lack of data for fin fish. Marine litter is an international issue, but there has been an encouraging decrease in litter on our beaches. Our seas are getting noisier and busier, but again the status of Underwater noise is uncertain due to a lack of data and thresholds for GES.

Our seas are getting warmer, more acidic and oxygen-depleted, which has a knock-on effect on marine ecosystems

Climate change and ocean acidification will increasingly alter the prevailing conditions in UK seas in coming decades and these changes may affect the achievement of GES in the future. While impacts of climate change are evident in the UKMS assessments, most indicators of GES have not identified the change in prevailing conditions as the primary driver for meeting or not meeting GES.

The impacts from climate change can vary across UK seas, they can also be short-lived and localised. For example, whilst sea surface temperatures (SST) are increasing around the UK, the highest rates of warming have been observed in the southern North Sea. Short-lived extremes in temperature, called marine heatwaves, have also become more common. Alongside these changes, our seas are becoming more acidic because of rising levels of atmospheric CO2 and are increasingly deprived of oxygen, particularly in late summer.

Data transparency

We have made the results and methodologies for the individual indicators used to assess GES digitally available on the Marine Online Assessment Tool (MOAT).

Key	Status
	GES met
	GES Partially Met or Uncertain
	GES Not Met
	Indicator Not Used

GES Overview

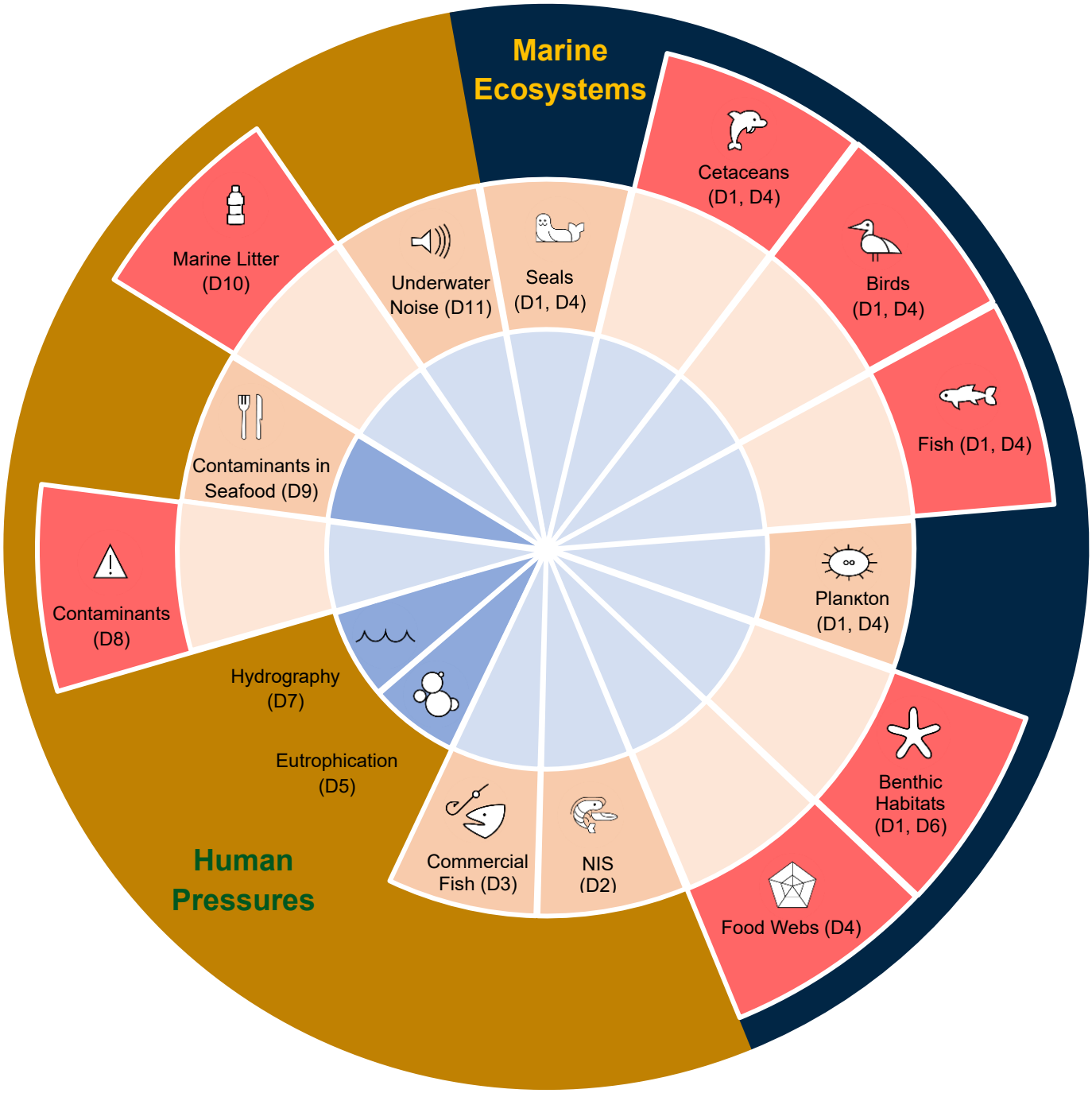


Figure 1: A visual summary of the state of UK seas from the 2024-25 assessments. We expect to update these assessments in 2030, using the OSPAR Interim Assessments 2029 (IA29) as the starting point for shared indicators.

GES status summaries

Table 1: GES Status Summaries, showing the relative status of each UKMS descriptor.

Component	Status
Seals (D1, D4) 	Overall, GES for seals has been partially met. Data availability limits our capacity to assess status but, where evidence exists, the picture is mixed. GES has been met for grey seals across their range. Harbour seals have not achieved GES in the Greater North Sea.
Cetaceans (D1, D4) 	Cetaceans, overall, have not met GES in UK seas. Data availability limits our capacity to assess status, particularly for abundance and distribution, but where evidence exists the picture is mixed.
Birds (D1, D4) 	Despite a reduced threat from invasive mammals at important marine bird island breeding sites, marine birds in both the Greater North Sea and Celtic Seas regions have not met GES.
Fish (D1, D4) 	Fish have not met GES across UK seas despite the improving status of some individual populations of sensitive fish. Most assessed populations of sensitive fish species were no longer declining in both the Greater North Sea and Celtic Seas (stable or increasing). However, there are long-term declines in the proportion of large demersal fish.
Pelagic Habitats (D1, D4) 	The environmental status for pelagic habitats in UK seas remains uncertain due to the lack of a suitable model for assessing GES and low confidence in the results. All currently available evidence suggests, however, that pelagic habitats in UK seas are in “not good” status.
Benthic Habitats (D1, D6) 	Despite some improvements, the overall picture is still one of deterioration, particularly for sensitive habitats and both the Greater North Sea and Celtic Sea regions have not met GES.
Non-indigenous Species (D2) 	The environmental status for NIS is uncertain for both the Celtic Seas and the Greater North Sea, due to data limitations and a lack of comprehensive monitoring in UK waters.
Commercial Fish and Shellfish (D3) 	Overall, commercially exploited fish and shellfish have partially met GES across UK waters. Our assessment (for the period 2016-2021) shows 42% of marine quota fish stocks and 11% of non-quota shellfish stocks have achieved GES. This is an increase of 9% for marine quota and 6% for non-quota shellfish stocks.

Food Webs (D4) 	Food webs have not met GES across the marine strategy area. Demersal fish species have not achieved GES. Plankton community indicators show decreasing productivity trends. Change in fish feeding guild biomass was mixed with spatially extensive increases in benthivores.
Eutrophication (D5) 	Eutrophication has largely met GES in UK seas. The majority (95%) of UK coastal, shelf and oceanic areas are found to be at GES. However, 3% of coastal waterbodies have not achieved GES with a further 2% at risk of not achieving GES into the future due to levels of dissolved nitrogen.
Hydrographical Conditions (D7) 	We assert that hydrographical conditions in UK seas continue to meet GES, based on the premise that our marine planning, licensing and consenting regimes remain sufficient to mitigate for significant impacts on this descriptor.
Contaminants (D8) 	All criteria for contaminant concentrations in UK seas have met or partially met GES, except for contaminant concentrations for four heavy metals (lead, mercury, copper, zinc) and two other persistent pollutants (CB118 and BDE209) which are above environmental thresholds. Consequently, overall, UK waters have not met GES for contaminants.
Contaminants in Seafood (D9) 	Contaminant concentrations in UK seafood have met GES for shellfish. Recent surveys (2016 – 2020) of contaminant concentrations for hazardous substances only contained data from shellfish. As no fish have been sampled for contaminants in seafood, no GES assessment for fish could be carried out.
Marine Litter (D10) 	The UK has not met GES for marine litter. Overall marine litter levels remain high, although we are seeing encouraging reductions in beach litter and plastics found in the stomachs of fulmar. Litter on the seafloor remains high in the Greater North Sea.
Underwater Noise (D11) 	The environmental status for Underwater noise in UK seas is uncertain. This is because threshold values for GES have yet to be defined. Both underwater noise indicators (impulsive and continuous) show an increasing trend across the assessment period, suggesting our seas are becoming noisier.

Introduction

Tompot Blenny (*Parablennius gattorugine)*
Plymouth Sound and Estuaries SAC

The UK Marine Strategy Regulations

The Marine Strategy Regulations 2010 (MSR) require the UK, devolved governments of Scotland and Wales and the Department of Agriculture, Environment and Rural Affairs for Northern Ireland (DAERA) to take action to achieve or maintain good environmental status (GES) through the production of a "Marine Strategy" for all UK waters. Publication of the first UKMS (Parts One to Three between December 2012 and December 2015) marked a significant step toward protecting and restoring the UK marine environment and using marine resources sustainably. This consultation marks the beginning of the third implementation cycle of the UK Marine Strategy (UKMS) as required by the MSR.

The UK Marine Strategy

The UKMS provides the overarching framework for achieving GES, setting out how we will measure, assess and respond to the state of our seas. It enables us to identify where our seas most need support to reverse the decline in marine ecosystems while allowing the sustainable use of marine resources. It also aligns with key international obligations and commitments to protect and preserve the marine environment, such as the UN Convention on the Law of the Sea (UNCLOS), UN Sustainability Goal 14 (Life Below Water, the North East Atlantic Environment Strategy 2030. The UKMS plays a central role in the UK National Biodiversity Strategy and Action Plan (NBSAP), which sets out how the UK will implement the Kunming-Montreal Global Biodiversity Framework under the Convention on Biological Diversity (CBD).

Structure

The UKMS uses a 3-part structure to monitor, assess and take action for our seas, applying an ecosystem-based approach to marine management. In doing so, it seeks to recover the marine environment where practicable and keep the collective pressure of human activities within levels compatible with the achievement of GES:

- **UKMS Part One:** an assessment of marine waters, setting and updating the characteristics of GES (known here as 'overarching targets', previously called 'high level objectives for GES), GES criteria, and targets, alongside the indicators used to measure progress towards GES (first published December 2012; updated in 2019).
- **UKMS Part Two:** sets out the monitoring programmes to monitor progress against the targets and indicators (first published August 2014; updated in 2022).
- **UKMS Part Three:** sets out a Programme of Measures (PoM) for achieving GES (first published December 2015; updated in March 2025).

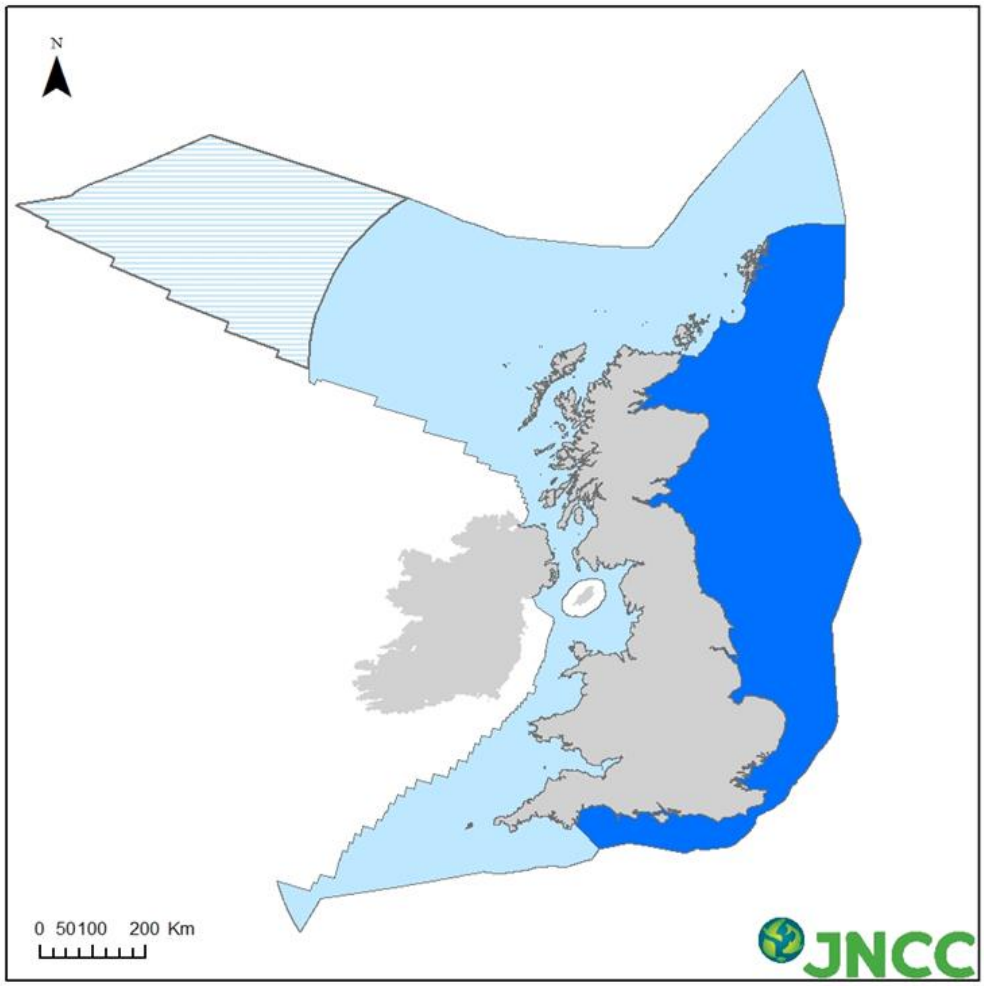


Figure 2: The area of UK waters to which the UK Marine Strategy applies, and the relevant sub-regions.

Geographic and Administrative Scope

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 Spring tides (MHWS) to the outer limit of the UK Exclusive Economic Zone (EEZ). It also includes the seabed in the area of the continental

shelf[1] beyond the EEZ over which the UK exercises jurisdiction (figure 1). The waters to the west of the UK comprise part of the Celtic Seas sub-region, and waters to the east of the UK, including the Channel, form part of the Greater North Sea sub-region.

The role of OSPAR

Whilst we now govern our own waters, and have legislation to do so, we continue to cooperate with other countries sharing our seas. We are formally integrating findings from the Oslo Paris Regional Seas Convention (OSPAR) Quality Status Reports 2023 (QSR) into our UK-specific assessments for the first time. This has delivered significant efficiencies and savings and allows us to present a picture for our shared sea areas, alongside issues that are more particular to our waters. Where we have used additional indicators over and above the OSPAR assessments this has been made clear. Our UK assessment results are consistent with those of the QSR.

Marine Protected Areas: an update

MPAs are one of the most important tools we have for protecting the wide range of important and sensitive habitats and species within UK waters. We have continually increased our network of MPAs from 217 sites covering 8% of UK waters in 2012, to 314 designated MPAs protecting 24% of UK waters in 2018. We have now completed our 'ecologically coherent network' of MPAs. As of May 2024, the UK has designated 374 MPAs, covering 38% of UK waters in total.

Each devolved government approaches the designation of MPAs differently. Defra, the Welsh Government, the Scottish Government and the Department of Agriculture, Environment and Rural Affairs for Northern Ireland have recently reported on progress on their components of the MPA network. Figure 3 below shows the location of all MPAs in UK waters.

In England

We have established a comprehensive network of 181 MPAs covering 40% of English waters and set a legally binding target that requires at least 70% of protected features in MPAs to be in a favourable condition by the end of December 2042 with the remainder in recovering condition. We are now focused on the effective management of these sites, which will continue to play an essential role in achieving GES for our seas. The UK government has been increasing protections within MPAs in line with our environmental targets and obligations. We are also undertaking a review of the MPA network in England with the aim of future-proofing the network, for example in terms of climate change adaptation and mitigation.

[1] This area is defined by the Continental Shelf Act 1964.

- Marine Protected Areas network Report 2012-2018

In Scotland

The MPA network covers 37% of Scottish waters and is comprised of 233 sites designated for nature conservation purposes. Work is currently underway to develop and implement management measures for fishing activity for those MPAs where they are required and are not already in place.

- Marine Protected Areas Network 2024 Report to the Scottish Parliament

In Wales

Wales has 139 Marine Protected Areas, covering 69% of inshore waters and 50% of all Welsh waters. There are several types of MPAs used in Wales, which offer different levels of protection. As part of the MPA network completion programme, Welsh Government are proposing to designate further MCZs to address shortfalls previously identified. 6 areas of search have been identified in Wales focusing on benthic features.

- Welsh government

In Northern Ireland

The inshore MPA network currently consists of 48 protected areas, accounting for 38% of the inshore region. The 2024 DAERA Environmental Statistics Report stated that 87% of marine habitat features and 71% of marine mammal features were in favourable status. Northern Ireland's MPA strategy is regularly reviewed to maximise co-benefits that a well-managed MPA network can provide.

- Department of Agriculture, Environment and Rural Affairs Northern Ireland

The Joint Nature Conservation Committee (JNCC)

The Joint Nature Conservation Committee (JNCC) has developed an MPA mapping tool: The mapper displays MPA boundaries in all UK and Crown Dependency waters, and protected feature information for sites within UK offshore waters. It provides a clear and consistent evidence base to support stakeholder engagement and management of the MPA network.

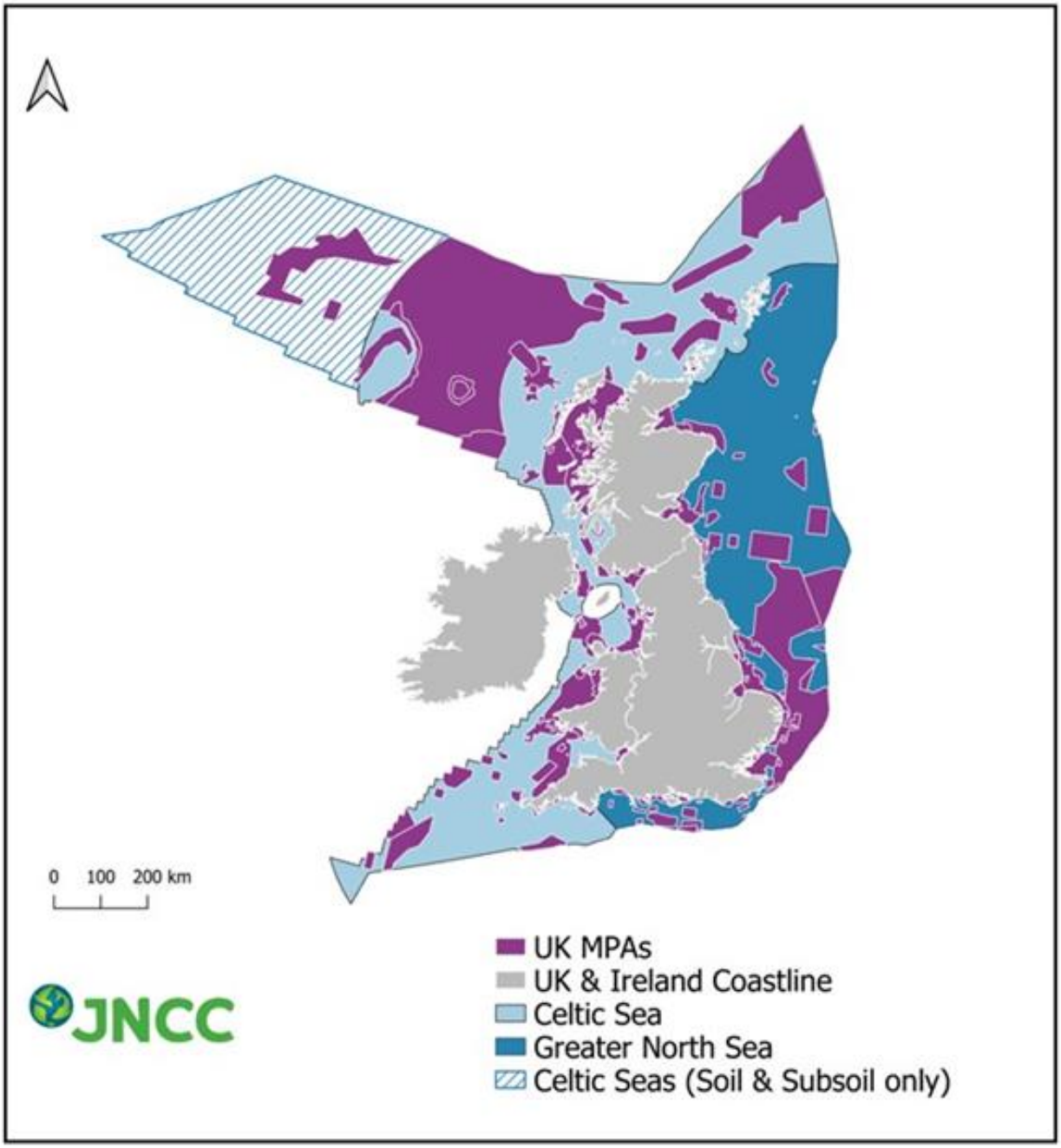


Figure 3: Locations for all current Marine Protected Areas in UK waters (in 2024).

Good Environmental Status (GES)

GES is defined as the environmental status of marine waters where these provide ecologically diverse and dynamic oceans and seas which are clean, healthy and productive within their intrinsic conditions, and the use of the marine environment is at a level that is sustainable, thus safeguarding the potential for uses and activities by current and future generations. It consists of 11 'Descriptors', which together comprise an ecosystems-based approach by considering marine ecosystem health (state) alongside human activities (pressures):

Table: Ecosystem health (state) descriptors

Name	Code	Description
Biodiversity	D1	Represented by assessments for seals, cetaceans, fish, birds, pelagic and benthic habitats
Food Webs	D4	The overall state of marine food webs (including seals, cetaceans, birds, fish, pelagic habitats and benthic habitats)
Seafloor Integrity	D6	The condition of the seabed

Table: Human activity (pressure) descriptors

Name	Code	Description
Non-Indigenous Species	D2	The extent to which marine ecosystems are impacted by non-indigenous species
Commercial fish	D3	Levels of fishing pressure and the resultant state of commercial stocks
Eutrophication	D5	Changes to levels of nutrients and dissolved oxygen resulting from human activities
Hydrographical Conditions	D7	Changes in our marine environment resulting from artificial structures and developments
Contaminants	D8	The presence of contaminants from human sources
Contaminants in Seafood	D9	The presence of contaminants in seafood
Marine Litter	D10	The prevalence of human-generated waste items in our seas
Underwater Noise	D11	Levels of noise resulting from human activities

How we assess progress towards the achievement of GES

This update to the UKMS Part One covers the whole of UK marine waters. Where there are significant biogeographical differences between the Greater North Sea and the Celtic Seas sub-regions these have been taken into account. Assessments are undertaken at the scale most relevant to the particular descriptor or ecosystem component. This can be at sub-regional scale or smaller where appropriate.

Many of the species and habitats are common across the OSPAR maritime region and populations of species tend to exist at the regional scale. This means that the OSPAR QSR indicator and thematic assessments can provide a more accurate picture of the state of our seas in some instances. In the Marine Strategy Part 2, we set out the specific monitoring programmes we would use to assess achievement of GES. Wherever possible we carry out our monitoring programmes together with OSPAR contracting parties through the Joint Assessment and Monitoring Programme (JAMP), using agreed methods, common indicators and assessment criteria. Consequently, over half of all indicators used in our assessments have been developed in collaboration with OSPAR contracting parties. Where used, these achieve efficiencies of scale and a consistent approach to the way we monitor, assess and manage the seas we share with our European neighbours. Figure 2 below sets out the relationship between different assessments and their synthesis.

Domestic assessments were carried out by experts and scientists working in the UK Marine Monitoring and Assessment Strategy (UKMMAS) Evidence Groups. These are coordinated in turn by the UK Monitoring and Assessment Reporting Group (MARG). Many of these experts also contribute to the OSPAR QSR. More information about how we monitor, assess and compile reports on the state of our seas can be found in the companion sections of MOAT.

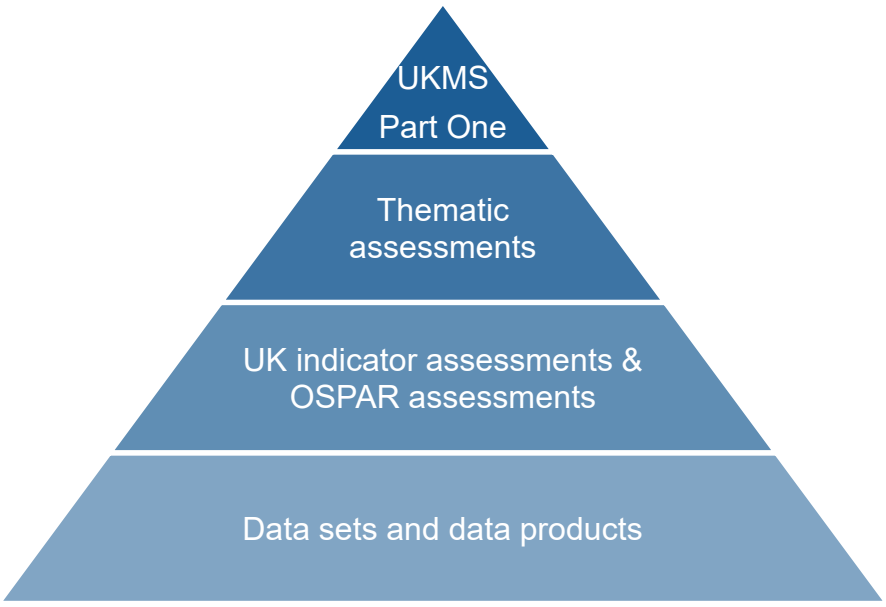


Figure 4: Schematic diagram showing assessment structure and process

GES and ecosystem services

A healthy marine ecosystem provides a range of ecosystem services - such as habitat provision and nursery grounds for marine species, nutrient regulation, carbon storage and natural defences against sea level rise – which in turn provide benefits to nature, people and the economy. Robust marine ecosystems in optimal states are also better able to respond to human-induced changes, while enabling the sustainable use of marine goods and services by present and future generations.

The UKMS applies an ecosystem-based approach to the management of human activities, ensuring that the collective pressure of such activities is kept within levels compatible with the achievement of GES. Work is underway to understand and quantify the relationship between GES and ecosystem services.

Socioeconomic analysis

As part of our determinations of GES, the Marine Strategy Regulations require that we must take account of the predominant pressures and impacts of human activities on the marine environment in the Marine Strategy Area (see figure 1). In our 2019 update of the UKMS Part One we provided an analysis and comprehensive overview of the socio-economic value of the marine environment using data from the Office for National Statistics (ONS). The ONS has yet to update this data. We have chosen, therefore, not to repeat this data and analysis here.

There is a range of alternative socioeconomic data and evidence which do provide a useful indication of the value marine industry sectors. Comparison between these figures is not advised because methodologies may vary.

Please visit the Marine Online Assessment Tool (MOAT), for more detailed analysis of the socioeconomic importance of the marine environment, along with additional information about the value of ecosystem services to society, and the main activities and pressures impacting on each descriptor.

Assessments and targets

Grey Seal (*Halichoreus grypus*) Pembrokeshire Marine SAC

How we have set out our GES assessments

The detailed Thematic Assessments and associated Indicator Assessments that underpin this update to the UKMS Part One can be found on MOAT. There you will also find the operational objectives proposed by the assessors for each descriptor. These have been proposed by the evidence groups during the development of the thematic assessments and mostly relate to monitoring programmes. These will be considered when we next update the UKMS Part Two (monitoring programmes). The UKMS Part Three Programme of Measures set out what steps we are taking to achieve GES (previously known as 'going forward' in the last update in 2019).

Component	Purpose
Status and indicator assessments	A statement setting out the overarching targets for GES (also known as GES characteristics, previously called 'High level objective for GES') that have been agreed for each descriptor alongside overall assessment status.
Technical detail for next cycle	An overview of the different criteria, targets and the status of associated indicators for each descriptor.
Trend since 2019	An overview of trends relative to GES, dating back to our initial assessment in 2012 where possible.
Headline pressures	A summary of the main pressures impacting each descriptor.
Evidence and policy challenges	A summary of the issues we need to address to help us understand how and where to take action to achieve GES.
The likely impacts of climate change	How experts consider each descriptor is being impacted by climate change.

Marine Mammals (D1, D4)


Seals – status and indicator assessments

Please visit MOAT for the full, detailed Thematic Assessment for Seals (D1, D4).

Four OSPAR Common Indicator Assessments were integrated following agreed methods to generate an overarching status assessment for marine mammals in the OSPAR North-East Atlantic. GES for the four marine mammal functional groups was assessed as 'not met' if at least one Common Indicator outcome failed.

Overarching target

The population abundance and demography of seals indicate healthy populations that are not significantly affected by human activities.

Overarching status: partially met

Overall, GES for seals in the UK has been partially met. Data availability limits our capacity to confidently assess status but where good evidence exists, the UK picture is mixed. GES has been met for grey seals across their range. Harbour seals have not yet achieved GES in the Greater North Sea.

Table: Status of seals in the Greater North Sea and Celtic Seas, by criteria

Criteria	2019 Target	Status: Greater North Sea	Status: Celtic Seas	Indicator
1: Bycatch mortality	The long-term viability of seal populations is not threatened by incidental bycatch.	Partially met	Partially met	Marine mammal bycatch (OSPAR D1M6)
2: Population demographic characteristics	Population abundance and distribution are consistent with favourable conservation status.	Partially met	Partially met	Changes in abundance and distribution of seals (OSPAR D1M3)
3: Population demographic characteristics	Grey seal pup production does not decline substantially in the short or long-term.	Met	Met	Grey seal pup production (OSPAR D1M5)

Technical detail for the next cycle

GES overarching target

The abundance and distribution trends of seals indicate healthy populations that are not significantly affected by human activities.

Criteria	2024 target	Indicator
1: Bycatch mortality	The long-term viability of seal populations is not threatened by bycatch, and the trend in bycatch estimates is decreasing.	Marine mammal bycatch (OSPAR D1M6)
2: Population abundance and distribution	Abundance and distribution trends are stable where good status is established or improving where species or populations are not achieving GES.	Changes in abundance and distribution of seals (OSPAR D1M3)
3: Population abundance and distribution	Grey seal pup production remains stable where good status is established or improves where populations are not achieving GES.	Grey seal pup production (OSPAR D1M5)

Trend since 2019

- There is no clear evidence of improvement in relation to GES compared to previous assessments.
- Refined assessment methodologies, developed by OSPAR, will improve the identification of trends in future assessments.

Grey seals

- Grey seal abundance and distribution has continued to increase across the UK.

Harbour seals

- Harbour seals in the Greater North Sea are in a further state of decline compared to previous assessments due to the continued decline of the species in north-east Scotland and a more recent sustained decline in the south-east of England.
- Harbour seal abundance is stable on the west coast of Scotland, but their status in other parts of the Celtic Seas remains uncertain.

Headline pressures

The main human induced pressures acting on seals are bycatch, physical disturbance, marine noise, chemical pollutants and climate change. Some of these pressures derive from social and economic needs for sustained and increased food, energy and national security, as well as health and well-being. Predator-prey interactions are also a significant pressure.

Evidence and policy challenges

Evidence gaps are primarily being addressed collectively through coordinated research and management actions including:

- the Marine Wildlife Bycatch Mitigation Initiative (BMI) and others.

We will also look to:

- Explore the likely impacts of climate change on seals, to clarify how management may need to adapt as changes in the environment occur.
- Develop a methodology that enables us to assess the cumulative impacts of human-induced threats to seals.
- Understand the causes of declines in harbour seal populations across the UK.

Cetaceans – status and indicator assessments

Please visit MOAT for the full, detailed Thematic Assessment for Cetaceans (D1, D4).

Four OSPAR Common Indicator Assessments were integrated to generate an overarching status assessment for marine mammals in the OSPAR North-East Atlantic. Status for the four marine mammal functional groups was assessed as 'not good' if at least one Common Indicator outcome failed.

The appropriate scale for the assessment of GES for some of the more highly mobile and widespread marine mammals is larger than that of the UKMS regional seas. Through applying the outputs from the OSPAR QSR23, assessment scales for some species extend into the wider Northeast Atlantic regions used by OSPAR (e.g. Region IV: Bay of Biscay and Iberian Coast), which is more representative of the natural population ranges of these species. Where this is the case, the UK outlook for the species within the wider OSPAR QSR23 assessment outputs is described in further detail.

Overarching target

The population abundance of cetaceans indicates healthy populations that are not significantly affected by human activities.

Overarching status: not met

Cetaceans overall have not met GES across both the Celtic Seas and Greater North Sea sub-regions. Data availability limits our capacity to confidently assess status, particularly for abundance and distribution, but where good evidence exists the UK picture is mixed.

Table: Status of cetaceans in the Greater North Sea and Celtic Seas, by criteria

Criteria	2019 Target	Status: Greater North Sea	Status: Celtic Seas	Indicator
1: Bycatch mortality	The long-term viability of cetacean populations is not threatened by incidental bycatch.	Not met	Not met	Marine mammal bycatch (OSPAR D1M6)
2: Population demographic characteristics	**Population Abundance** There should be no significant decrease in abundance caused by human activities.	Met	Not met	Abundance and distribution of cetaceans (OSPAR D1M4)
3: Population demographic characteristics	**Population Distribution** Population range are not significantly lower than favourable reference values for the species.	Met	Not met	Abundance and distribution of cetaceans (OSPAR D1M4)

Technical detail for the next cycle

GES overarching target

The abundance and distribution trends of cetaceans indicates healthy populations that are not significantly negatively affected by human activities.

Criteria	2024 target	Indicator
1: Bycatch mortality	The long-term viability of cetacean populations is not threatened by bycatch, and the trend in bycatch estimates is decreasing.	Marine mammal bycatch (OSPAR D1M6)
2: Population abundance and distribution	Abundance and distribution trends are stable where good status is established or improving where species or populations are not achieving GES.	Abundance and distribution of cetaceans (OSPAR D1M4)

Additional indicators for Marine Mammals	There is potential to consider the outputs from the UK indicator on impulsive and continuous noise, and how this might contribute to assessment of GES of marine mammals. There is scope to consider the development of an indicator specifically designed to highlight trends likely linked to climate change to support identification of resilience of species to climate change impacts.	

Trend since 2019

- There is no clear evidence of improvement in relation to GES compared to previous assessments.
- Bycatch estimates for harbour porpoise remain broadly similar to 2019 – no other species was assessed for this.
- OSPAR is refining threshold-setting and associated assessment methodologies to improve the identification of trends in future assessments.

Headline pressures

The main human-induced pressures acting on cetaceans are bycatch, marine noise, chemical pollutants, and climate change. Some of these derive from social and economic needs for sustained and increased food, energy and national security, as well as health and well-being.

Evidence and policy challenges

As with seals (D1, D4), evidence gaps are primarily being addressed collectively through coordinated research and management actions set out in a range of initiatives, including:

- The UK Dolphin, Porpoise and Whale Conservation Strategy , now called the UK Cetacean Conservation Strategy
- The Marine Wildlife BMI and others
- Northeast-Atlantic Small Cetaceans in European Atlantic waters and the North Sea (SCANS) surveys.
- Initiatives such as the Joint Cetacean Data Programme which support the standardising and collating of marine mammal datasets to strengthen the evidence base available for strategy and management decisions.

We will also consider:

- Mechanisms to evaluate the cumulative impacts of human-induced pressures.
- The likely impacts of climate change on cetaceans.
- Engagement with the EU Life CIBBRiNA international bycatch programme to coordinate efforts to mitigate pressures across shared seas.

Likely impacts of climate change on marine mammals

Climate change is impacting the availability of suitable habitats, the primary production cycle and key life history events and the prevalence of disease in marine mammals.

Although grey seal, bottlenose dolphin and harbour porpoise distribution has expanded southwards, there is some evidence that UK marine mammal distributions may be shifting northwards, with some dolphin species previously observed in warmer, more southern waters being recorded more frequently further north. This corroborates with increasing average sea surface temperatures and northward shifts in commercial fish species, of which several feature in the diet of various marine mammal species.

Increased occurrence of harmful algal blooms, exposure to novel pathogens and thermal stress in marine mammals because of higher temperatures and stronger stratification of the water column intensify the prevalence and susceptibility to disease and negative impacts on reproductive success in marine mammals.

Increased storm frequency and sea level rise have also resulted in higher mortalities of grey seals at breeding sites around the UK. More regular occurrences of these events have the potential to impact future trends in abundance.

Marine Birds (D1, D4)

Status and indicator assessments

Please visit MOAT for the full, detailed Thematic Assessment for Marine Birds (D1, D4).

The overarching assessment for the status of the biodiversity of marine birds follows a similar approach to that taken by the OSPAR QSR marine bird thematic assessment and their Coordinated Environmental Monitoring Programme (CEMP). This allows us to bring together and integrate findings from three indicators: marine bird abundance, marine bird breeding productivity and the non-breeding component of the marine bird distribution indicator. From this, we can build a clear picture for the status of marine birds as presented here. The invasive mammal indicator could not be integrated due to this assessment not being species specific.

Overarching target

The abundance and demography of marine bird species indicate healthy populations that are not significantly affected by human activities.

Overarching status: not met

Despite a reduced threat from invasive mammals at important marine bird island breeding sites, marine birds in both the Greater North Sea and Celtic Seas regions have not met GES.

Table: Status of marine birds in the Greater North Sea and Celtic Seas, by criteria

Criteria	2019 Target	Status: Greater North Sea	Status: Celtic Seas	Indicator
1: 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.	Not used	Not used	Seabird bycatch
2: Population abundance	The population size of marine bird species has not declined substantially since 1992 as a result of human activities.	Not met	Not met	Marine bird abundance – (OSPAR D1B1)
3: 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.	Not met	Not met	Marine bird productivity – (OSPAR D1B3)
3: 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.	Not met	Not used	Kittiwake breeding success (B2)
3: 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.	Met	Met	Invasive mammal presence on island seabird colonies (B4)
4: Distributional range	There is no significant change or reduction in population distribution of marine birds caused by human activities.	Met	Met	Distribution of breeding and non-breeding marine birds (B6)

Technical detail for the next cycle

GES overarching target

The abundance and demography of marine bird species indicate healthy populations that are not significantly affected by human activities.

Criteria	2024 target	Indicator
1: 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 (OSPAR Pilot D1B5 – to be developed)
2: 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 D1B1)
3: 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 productivity – (OSPAR D1B3) - Kittiwake breeding success (B2) - Invasive mammal presence on island seabird colonies (B4)
4: Distributional 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 (B6)

Trend since 2019

- The inclusion of the non-breeding marine bird component of the invasive mammals indicator in this assessment makes comparison with the previous assessment challenging.
- Of the five functional feeding groups of marine birds assessed, water column and grazing feeding marine birds were both at GES.
- In 2019 only non-breeding marine birds in the Greater North Sea were assessed as being consistent with GES.
- The OSPAR QSR 2023 thematic assessment suggests there have been some improvements across the groups and regions, but the overall status for each species group has not changed.

    - *We note the recent Birds of Conservation Concern Red List assessment[2]. It has not been integrated into this assessment as it was not ready in time for the assessors to consider.*

- A comparison between the Greater North Sea and Celtic Seas regions shows that the abundance of non-breeding marine birds has declined, with the Greater North Sea dropping below target.
- Breeding success for both regions has declined.
- Good progress has been made with the Invasive Mammal indicator.

Headline pressures

Due to the diversity of marine bird species, which use various marine and terrestrial habitats and feeding strategies, it is not simple to summarise pressures acting on marine birds. Climate change poses a significant pressure on many marine bird species through indirect (changes in availability of fish prey) and direct effects (exposure extreme weather conditions). Other pressures include those associated with fisheries (direct exploitation of prey species such as sandeel and mortality from incidental by-catch in fishing gear), disturbance from industrial or recreational activity, habitat loss and pollution. Breeding birds are under pressure from invasive non-indigenous mammalian predators and from habitat loss due to development.

Evidence and policy challenges

- We have a UK Government-wide initiative to develop conservation actions for marine birds. Each devolved government is at a different stage with their respective policies for these.
- We recognise the need to establish a suitable framework that enables us to monitor and assess the success of these and other measures and their implementation, alongside the strategic objectives set out in the North-East Atlantic Environment Strategy 2030 (NEAES). This would be done separately by each administration as defined in their specific marine bird recovery strategies.

Other significant challenges include:

- Establishing a detailed picture of the extent of the impacts caused by single-point events, such as outbreaks of Highly Pathogenic Avian Influenza (HPAI) in 2021-2023, and the auk and shag wrecks in 2021 and 2023.
- Protecting prey species such as the approach by UK and Scottish Governments since 2024 to manage sandeel fisheries.

[2] *The status of the UK's breeding seabirds: an addendum to the fifth Birds of Conservation Concern in the United Kingdom, Channel Islands and Isle of Man and second IUCN Red List assessment of extinction risk for Great Britain (britishbirds.co.uk)*

The likely impacts of climate change

Climate change is one of the most significant threats to marine birds globally and is an important driver for change in the UK and wider Northeast Atlantic. The main impact pathways of climate change on marine birds are outlined in the 2023 QSR thematic assessment. Determining precise cause and effect relationships can, however, be challenging.

For example, large-scale changes such as warming seas can reduce prey availability (e.g. sandeels, sprat), whereas small-scale changes and single-point events (e.g. storms) can impact birds and their reproductive capacities, as shown in the Review of climate change mechanisms affecting seabirds within the INTERREG VA area.

We see this with the kittiwake breeding success indicator which is able to separate the effects of climate change and impacts from additional human activities on kittiwake productivity by accounting for climate change impacts within the assessment. Going forward, improved understanding of the frequency and impacts of random or unpredictable events, through a changing climate and disease outbreaks, will ensure the reliability of this indicator is maintained.

Climate change can also affect the distribution of some species. The non-breeding component of UK only marine bird distribution indicator showed that species such as spoonbill and little egret, more usually associated with warmer climes, have expanded their distribution to the UK.

Fish (D1, D4)

Status and indicator assessments

Please visit MOAT for the full, detailed Thematic Assessment for Fish (D1, D4).

In the Greater North Sea area and Celtic seas 37 and 38 sensitive species were assessed respectively. The below indicators were developed in collaboration with the OSPAR contracting parties to inform the latest QSR 2023. Since 2019, the UK has worked with OSPAR to refine the population abundance indicator (now titled occurrence) to give population by population assessment outcomes for a greater range of species.

Overarching target

The abundance and demography of fish indicate healthy populations that are not significantly affected by human activities.

Overarching status: not met

Fish have not met GES across UK seas despite the improving status of some individual populations of sensitive fish. Most assessed populations of sensitive fish species were no longer declining in both the Greater North Sea and Celtic Seas (stable or increasing). However there are long-term declines in the proportion of large demersal fish being evident in both regions.

Table: Status of fish in the Greater North Sea and Celtic Seas, by criteria

Criteria	2019 Target	Status: Greater North Sea	Status: Celtic Seas	Indicator
1: Population occurrence	The occurrence of sensitive species is not decreasing due to anthropogenic activities and long-term viability is ensured.	Not met	Not met	Recovery of Sensitive Fish Species (OSPAR FC1)
1: Population occurrence	The occurrence of sensitive species is not decreasing due to anthropogenic activities and long-term viability is ensured.	Not met	Not met	Size Composition in Fish Communities (OSPAR FW3)
1: Population occurrence	The occurrence of sensitive species is not decreasing due to anthropogenic activities and long-term viability is ensured.	Not met	Not met	Proportion of Large Fish (Large Fish Index - OSPAR FC2)
1: Population occurrence	The occurrence of sensitive species is not decreasing due to anthropogenic activities and long-term viability is ensured.	Not met	Not met	Pilot Assessment of Feeding Guilds (OSPAR FW7)
1: Population occurrence	The occurrence of sensitive species is not decreasing due to anthropogenic activities and long-term viability is ensured.	Not met	Not met	Pilot Assessment of Mean Maximum Length of Fish (OSPAR FC3)
2: Bycatch mortality	Incidental bycatch is below levels which threaten long-	Not used	Not used	

	term viability and recovery of fish populations.			

Technical detail for the next cycle

GES overarching target

D1: The occurrence and bycatch of sensitive fish species indicate healthy populations that are not significantly affected by human activities.

D4: The health of the marine food web is not significantly adversely affected by human activities.

Criteria	2024 target	Indicator
1: Bycatch mortality	Incidental bycatch is below levels which threaten long-term viability and recovery of fish populations. (to be developed)	Bycatch mortality (to be developed)
2: Population occurrence	Sensitive species are not decreasing due to anthropogenic activities and long-term viability is ensured.	- Recovery of Sensitive Fish Species (OSPAR FC1) - Proportion of Large Fish (Large Fish Index - OSPAR FC2) - Pilot Assessment of Mean Maximum Length of Fish (OSPAR FC3) - Size Composition in Fish Communities (OSPAR FW3) - Pilot Assessment of Feeding Guilds (OSPAR FW7)

Trend since 2019

Demersal fish:

- Assessments in 2019 showed that demersal fish communities were recovering in the Greater North Sea and Celtic Seas.
- This trend has now reversed with the size-structure and species composition deteriorating. The substantial reduction in large cod and saithe in the northern North Sea is particularly significant in this trend.
- Despite overall declines, the typical length of demersal fish has increased in some subdivisions, including the Irish Sea, Bristol Channel, north-eastern English Channel and northern North Sea.

- There is some evidence that this increase followed the decrease in fishing effort by otter trawlers in the North Sea during the early 2000s.

Feeding guilds:

- Benthivores showed spatially extensive increases in both Greater North Sea and Celtic Seas.
- Piscivores and other feeding guilds higher in the food web also showed spatially extensive increases in biomass, but with decreases detected in the north and western North Sea.
- Planktivorous fish feeding lower in the food web declined in the Celtic Sea and north-western North Sea but increased in the English Channel, Bristol Channel and west of Scotland.
- There is evidence of a shift in species composition within the fish community, toward species that do not grow large, in the central and southern North Sea.

Sensitive fish:

- In 2019, a number of sensitive species were found to be increasing in abundance in the Greater North Sea and Celtic Seas.
- No further declines were found in 82% of assessed populations across the OSPAR area, including many populations (49%) that had increased in occurrence indicating recovery is underway for some populations.
- Several populations remain at their lowest observed levels, however, indicating depleted populations that are not recovering (27% in Celtic Seas and 21% Greater North Sea) including some with signs of recent further decline:
    - Starry ray (*Amblyraja radiata*) and pollack (*Pollachius pollachius*) in the North Sea and lumpfish (*Cyclopterus lumpus*) in the Celtic Seas.

Headline pressures

The extraction of biomass through fishing activities remains the dominant pressure on fish populations in the North-East Atlantic and most significant factor affecting the abundance of our fish species. Reduced fish biomass impacts feeding opportunities for marine predators such as marine birds and marine mammals and can potentially lead to a decrease in carbon fixation by the marine ecosystem. Additional pressure on fish habitat and migration routes arises from energy generation, coastal defence, land claim, aggregate extraction and climate change.

Evidence and policy challenges

We are seeing benefits of our interventions which continue to reduce anthropogenic pressures on our sensitive fish species, but the challenge remains**:**

- To continue to improve our understanding of cause and effect of individual and cumulative impacts of human-induced pressures on sensitive fish species in a dynamic marine environment.

- To make progress toward the development of a bycatch mortality indicator.

Other headline challenges include:

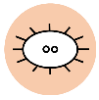
- The international nature of Total Allowable Catches (TACs) which are subject to negotiations through annual fisheries consultations with the EU and other coastal states: the UK will not be able to unilaterally achieve the targets without international cooperation.
- The recovery of fish communities is also affected by biological and climatic conditions, which are beyond the control of fisheries managers.

Likely impacts of climate change

General trends of ocean warming impacts include distributional shifts towards northern ranges of fish distributions; larger species decreasing in body size while smaller fish may more readily adapt to the environment; more rapid growth and earlier spawning; and changes in fish biomass which may be reflected through geographic changes in catch[3].

Earth system models suggest that climate associated changes in oceans include not only rising sea temperatures but also changes to primary production at the base of the food web, which can potentially impact on the food availability and habitat suitability for fish species.

Pelagic Habitats (D1, D4)



Status and indicator assessments

Please visit MOAT for the full, detailed Thematic Assessment for Pelagic Habitats (D1, D4).

The pelagic habitats assessment focuses on the past 60 years due to the time series of plankton monitoring. While offshore areas were extensively surveyed from 1960 by the Continuous Plankton Recorder (CPR) programme, coastal areas and river plumes had shorter time-series, typically commencing between 1980 and 2000.

The below indicators were developed in collaboration with OSPAR contracting parties to inform the latest QSR 2023. The indicators have been adapted to carry out a regional assessment for UK waters by our scientific experts. Sufficient spatial and temporal confidence among plankton time-series and high consistency among indicator results were required before GES could be determined. When these requirements were not met, status was designated “Unknown”.

[3] MCCIP Thematic Assessment on Fish

Overarching target

Pelagic habitats are not significantly adversely affected by human activities.

Overarching status: uncertain

The environmental status for pelagic habitats in UK seas is uncertain. There is currently no suitable model for assessing GES for pelagic habitats, this results in lower confidence with the GES assessment. However, all currently available evidence suggests that pelagic habitats in both the Greater North Sea and the Celtic Seas are both in “not good” status.

Table: Status of pelagic habitats in the Greater North Sea and Celtic Seas, by criteria

Criteria	2019 Target	Status: Greater North Sea	Status: Celtic Seas	Indicator
1: Habitat distribution and condition	The structure, function, composition, and abundance of the plankton community is not significantly adversely influenced by anthropogenic drivers.	Not met	Not met	Changes in plankton communities (OSPAR PH1/FW5)
1: Habitat distribution and condition	The structure, function, composition, and abundance of the plankton community is not significantly adversely influenced by anthropogenic drivers.	Not met	Not met	Changes in plankton biomass and / or abundance (OSPAR PH2)

Technical detail for the next cycle

GES overarching target

Pelagic habitats are not significantly adversely affected by human activities.

Criteria	2024 target	Indicator
1: Habitat distribution and condition	The structure, function, composition, and abundance of the plankton community is not significantly adversely influenced by anthropogenic drivers.	- Changes in plankton communities (OSPAR PH1/FW5) - Changes in plankton biomass and / or abundance (OSPAR PH2)

Trend since 2019

- The 2019 UKMS Assessment found that plankton communities in the Greater North Sea and Celtic Seas were experiencing important changes in biomass, abundance, and community structure.
- Expert judgement, rather than modelling, determined that prevailing oceanographic and climatic conditions were likely driving these changes despite the lack of a suitable assessment methodology.
- Improvements to the methodology for this 2024 assessment now show significant changes in the plankton community and we can be more confident that climate change and its effects on sea temperature and stratification is almost certainly impacting pelagic habitats.
- Interventions to reduce nutrient input from human induced sources have been more effective at reducing phosphorus than nitrogen. Under imbalanced conditions, influxes of nutrients due to increased precipitation and riverine input are more likely to trigger blooms and eutrophication events.
- Recent improvements to assessment methods will allow us to continue monitoring for changes in the plankton community and determine how these changes are linked to pressures in the marine environment.

Headline pressures

Climate change remains the most significant factor affecting the health of plankton communities in the Greater North Sea and Celtic Seas. Other significant human activities and pressures include inputs from land-based activities, shipping, pollution, waste discharge, and fisheries. Impacts occur at different scales.

Evidence and policy challenges

The assessment of GES in pelagic habitats would be improved by:

- Research into what constitutes conditions not adversely impacted by human activities, so that improved status relative to previous assessments can be detected.
- Improving our understanding of how changes in the plankton community are linked to pressures in the marine environment.

Other challenges include:

- That interventions to reduce nutrient input from human induced sources have been more effective at reducing phosphorus than nitrogen, generating an imbalance and increasing the vulnerability of pelagic habitats to land based nutrient pollution.

Likely impacts of climate change

Climate change is almost certainly affecting pelagic habitats in the Greater North Sea and Celtic Seas. Both pelagic habitat indicator assessments found strong links between

changes in plankton communities and plankton abundance/biomass with upward trends in sea temperature.

The Greater North Sea and Celtic Seas are currently experiencing increasing sea surface temperature due to climate change and decreasing pH due to ocean acidification. Elevated sea surface temperature enhances stratification, causing greater summer nutrient-depletion, and shifting the foundation of pelagic food webs towards a less desirable state, more dominated by small cells which contribute to longer food chains and less efficient transfer to fish.

There is evidence that warming and increased stratification due to climate change have led to widespread declines in key phytoplankton and their crustacean grazers, which are valuable food for fish. Plankton taxa that have increased in their place are unlikely to provide the same value to support fisheries.

Rising temperatures also drive northward trajectories in the distribution of planktonic lifeforms (taxa), many of which are adapted to a narrow temperature range. Many regions are seeing reductions in the abundance of common cold-adapted taxa unable to tolerate warmer temperatures, while previously uncommon warm-adapted taxa are moving in from the Atlantic.

Benthic Habitats (D1, D6)

Status and indicator assessments

Please visit MOAT for the full, detailed Thematic Assessment for Benthic Habitats (D1, D6).

Many of the below indicators were developed in collaboration with OSPAR contracting parties to inform the latest QSR 2023. The indicators have been adopted to carry out a regional assessment for UK waters by our scientific experts, and UK only indicators have been included to complement the OSPAR indicator results.

The assessment of benthic habitats was undertaken using a variety of biodiversity indicators and assessment methods applied at different scales. Due to limited data and scientific evidence, it was not possible to undertake a fully integrated assessment of benthic habitats at this stage.

UK benthic habitats have been assessed using twelve indicators, nine of which have been used to assess GES targets. The remaining three indicators do not currently have agreed thresholds to assess against a GES target; they are either pilots or currently there is insufficient information to provide indicator thresholds, although the indicator results still provide important contextual information and evidence.

Overarching target

The health of seabed habitats is not significantly adversely affected by human activities.

Overarching status: not met

Although there have been some improvements, the overall picture for benthic habitats is still one of deterioration, particularly for sensitive habitats. As a result, benthic habitats in both the Greater North Sea and Celtic Seas regions have not met GES.

Table: Status of benthic habitats in the Greater North Sea and Celtic Seas, by criteria

Criteria	2019 Target	Status: Greater North Sea	Status: Celtic Seas	Indicator
1: Spatial extent of physical loss	The physical loss of each seabed habitat type caused by human activities is minimised and where possible reversed.	Uncertain	Not used	Area of habitat loss
2: Habitat condition	Habitat loss of sensitive fragile or important habitats caused by human activities is prevented and where feasible reversed.	Not met	Not met	Potential physical loss of predicted biogenic habitats
3: 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 minimised.	Not met	Not met	Extent of Physical Disturbance to Benthic Habitats: Fisheries with mobile bottom contacting gears (OSPAR BH3a)
3: 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 minimised.	Met	Met	Extent of Physical Disturbance to Benthic Habitats: Aggregate Extraction (OSPAR BH3b)
3: Spatial extent of habitat type adversely affected by	The extent of habitat types adversely affected by physical disturbance caused	Not used (under development)	Not used (under development)	Offshore structures and other activities

physical disturbance	by human activity should be minimised.			
4: Extent of adverse effects	The extent of adverse effects caused by human activities on the condition, function and ecosystem processes of habitats is minimised.	Met	Met	Condition of intertidal seagrass communities in coastal waters determined using Water Environment Regulations methods
4: Extent of adverse effects	The extent of adverse effects caused by human activities on the condition, function and ecosystem processes of habitats is minimised.	Not met	Met	Condition of intertidal saltmarsh communities in coastal waters determined using Water Environment Regulations methods
4: Extent of adverse effects	The extent of adverse effects caused by human activities on the condition, function and ecosystem processes of habitats is minimised.	Met	Met	Condition of soft sediment invertebrate communities in coastal waters determined using Water Environment Regulations methods
4: Extent of adverse effects	The extent of adverse effects caused by human activities on the condition, function and ecosystem processes of habitats is minimised.	Not used	Met	Condition of intertidal rocky shore macroalgae (seaweed) communities in coastal waters determined using Water Environment Regulations methods

4: Extent of adverse effects	The extent of adverse effects caused by human activities on the condition, function and ecosystem processes of habitats is minimised.	Not met	Not met	Condition of intertidal sediments in coastal waters determined using Water Environment Regulations opportunistic macroalgae blooming assessment methods
4: Extent of adverse effects	The extent of adverse effects caused by human activities on the condition, function and ecosystem processes of habitats is minimised.	Not used	Not met	Condition of Benthic Habitat Communities based on the 'Relative Margalef' diversity index
4: Extent of adverse effects	The extent of adverse effects caused by human activities on the condition, function and ecosystem processes of habitats is minimised.	Not used	Not used	Intertidal Community Temperature Index (MarClim)
4: Extent of adverse effects	The extent of adverse effects caused by human activities on the condition, function and ecosystem processes of habitats is minimised.	Not used	Not used	Sentinels of the Seabed

Technical detail for the next cycle

GES overarching target

The health of seabed habitats is not significantly adversely affected by human activities.

Criteria	2024 target	Indicator
1: Spatial extent of physical loss	The extent of loss of a seabed habitat type caused by human activities is minimised and where possible reversed (should not exceed a set of agreed indicator thresholds).	Area of Habitat Loss (OSPAR BH4)
2: Habitat condition	Habitat loss of sensitive fragile or important habitats caused by human activities is prevented, and where feasible reversed (should not exceed a set of agreed indicator thresholds).	Potential Physical Loss of Predicted Biogenic Habitats (PPL)
3: Spatial extent of habitat type adversely affected by physical disturbance	4: The extent of habitat types adversely affected by physical disturbance caused by human activity should be minimised (should not exceed a set of agreed indicator thresholds).	- Extent of Physical Disturbance to Benthic Habitats: Fisheries with mobile bottom contacting gears (OSPAR BH3a) - Extent of Physical Disturbance to Benthic Habitats: Aggregate Extraction (OSPAR BH3b) - Extent of Physical Disturbance to Benthic Habitats: Offshore structures and other activities (OSPAR BH3c)

Extent of adverse effects	The extent of adverse effects caused by human activities on condition, function and ecosystem processes of habitats is prevented, and where feasible reversed (should not exceed a set of agreed indicator thresholds).	- Sentinels of the Seabed in the Celtic Seas and Greater North Sea (biological traits analysis to measure changes on ecosystem function) (OSPAR BH1 UK) - Condition of Benthic Habitat Communities: Nutrient and/or Organic Enrichment (OSPAR BH2a) - Condition of Benthic Habitat Communities based on the Relative Margalef diversity (OSPAR BH2b) - Condition of intertidal seagrass communities in coastal waters determined using Water Environment Regulations (WER) methods (WER Seagrass) - Condition of intertidal saltmarsh communities in coastal waters determined using Water Environment Regulations (WER) methods (WER Saltmarsh) - Condition of soft sediment invertebrate communities in coastal waters determined using Water Environment Regulations (WER) methods (WER IQI)

		- Condition of intertidal rocky shore macroalgae (seaweed) communities in coastal waters determined using Water Environment Regulations (WER) methods (WER Macroalgae) - Condition of intertidal sediments in coastal waters determined using Water Environment Regulations opportunistic macroalgae blooming assessment methods (WER Opp Mac) - Intertidal Community Temperature Index (MarClim) - Changes to the condition of biogenic reefs indicator - Condition of sublittoral rock habitats indicator

Trend since 2019

- Overall results on physical disturbance, physical loss, and changes to condition are comparable to those of 2019 and do not meet GES.
- Physical disturbance from fisheries with mobile bottom-contacting gears demonstrates some improvements with around two thirds of broad scale habitats in the Southern and Northern Celtic Sea achieving GES, although some threatened and declining habitats still show high levels of disturbance.
- The number of areas in which some indicators could be assessed in 2024 has decreased compared to 2019 due to a general reduction in monitoring. In particular, there was no assessment of disturbance from aggregate extraction in 2019.
- Opportunistic macroalgal growth, condition of benthic habitat communities based on the ‘Relative Margalef’ diversity index, intertidal community temperature index, area

of habitat loss, and changes to sensitive species (Sentinels of the Seabed) were not assessed against GES in 2019 so it is not possible to highlight a trend.

- Although there has been some small improvement towards the achievement of GES, the overall picture is still of continued deterioration, particularly for those habitats more sensitive to pressures (such as sublittoral coarse sediment, sublittoral sand, sublittoral mud, sublittoral mixed sediment and OSPAR listed Threatened and Declining Habitats).

Headline pressures

Benthic habitats in the UK are impacted by a range of activities that operate and/or interact with the biotic and abiotic components of the seafloor. Other activities that have an impact include shipping, fish and shellfish harvesting, extraction of minerals, tourism and leisure, renewable energy submarine cables, agriculture and aquaculture.

Evidence and policy challenges

- Actions taken by the UK, devolved governments of Scotland and Wales and DAERA (including in collaboration with other OSPAR contracting parties) for the management of specific human activities all contribute to addressing impacts from pressures and should, theoretically, contribute to improving the status of benthic habitats.
- While some improvements have been observed, current management measures need to be more effective, and in some cases, new measures may be needed to halt and reverse the decline in benthic habitats.
- The biggest challenge is to balance the protection of benthic habitats with the expansion of marine industries and ‘spatial squeeze’ in the marine environment.
- Stronger links between the results of this assessment and decision-making underpinning marine management are needed to ensure measures are effective in supporting the achievement of GES.

Likely impacts of climate change

Climate change and ocean acidification cause direct and indirect pressures which can significantly alter the environmental conditions (e.g. decreases in pH, increases in sea surface temperature) necessary for benthic ecosystem processes and functions. These changes can affect habitat suitability for sensitive benthic species, species distributions, community structure and diversity patterns.

Datasets available to systematically measure the effects of climate change and ocean acidification are limited. However, there is a large volume of evidence of the impacts across different regions. The main drivers impacting benthic habitats as a result of climate change are ocean acidification, increased sea temperature, increased freshwater inputs and changed salinity, slowed Atlantic Meridional Overturning Circulation, changes to rate of nutrient enrichment, increased sea level - including sea level rise at the coast, coastal erosion and heatwaves.

Benthic habitats can also provide solutions for the mitigation and adaptation of the effects of climate change. The natural carbon storage and sequestration capacity of some benthic habitats highlights their important role in the context of climate change and the importance of protecting relevant areas of seabed from pressures that degrade this capacity. Some benthic habitats, such as saltmarsh, provide natural flood and erosion protection.

The benthic biodiversity component has one indicator assessing response to changes in sea surface temperature on intertidal rock communities. This shows that changes in the intertidal community index are in line with expectations from temperature fluctuations in the region, with 2022 and 2023 being the warmest on record, suggesting that the change in community composition in the coming decade will be much larger.

Non-indigenous Species (NIS) (D2)

Status and indicator assessments

Please visit MOAT for the full, detailed Thematic Assessment for Non Indigenous Species (D2).

Threshold values for NIS indicators do not currently exist. Due to a lack of comprehensive NIS monitoring throughout the UK, there is low confidence in data used in the assessment of both indicators, so achievement of GES cannot be ascertained. Inconsistency in monitoring effort between years and reporting periods, and general spatial and temporal limitations of available data make interpretation of results challenging. Confidence in assessment is therefore low. The significance of delay in NIS reporting also cannot be ascertained. Furthermore, the conclusions drawn using the UK Marine Strategy assessment area omit data from transitional waters. These contain some high-risk locations for NIS introduction and spread, such as marinas and aquaculture sites. The results of this assessment should therefore be interpreted with these limitations in mind.

Overarching target

The rate of introduction of NIS, spread and impact of invasive NIS caused by human activities is not adversely altering ecosystems.

Overarching status: uncertain

The achievement of GES with respect to NIS is uncertain for both the Celtic Seas and the Greater North Sea due to data limitations and a lack of comprehensive NIS monitoring in UK waters.

Table: Status of non-indigenous species in the Greater North Sea and Celtic Seas, by criteria

Criteria	2019 Target	Status: Greater North Sea	Status: Celtic Seas	Indicator
1: NIS introductions	The number of newly introduced NIS as a result of human activities is minimised and where possible reduced to zero.	Uncertain	Uncertain	The number of new NIS introduced (OSPAR D2.1)
2: NIS distribution	The rate of spread of invasive NIS, as a result of human activities is minimised and reduced where possible.	Uncertain	Uncertain	The number of new populations of established invasive NIS

Technical detail for the next cycle

GES overarching target

The rate of introduction of NIS, spread and impact of invasive NIS caused by human activities is not adversely altering ecosystems.

Criteria	2024 target	Indicator
1: NIS Introductions	The number of newly introduced NIS is minimised.	The number of new NIS (OSPAR D2.1)
2: NIS Distribution	The rate of spread of invasive NIS, as a result of human activities is minimised and reduced where possible.	The number of new populations of established invasive NIS (UK only indicator D2.2)

Trend since 2019

- The previous UKMS assessment, conducted in 2018, found no significant change in the rate of new NIS introductions over time (2009-2014) and the current assessment concurs with the previous assessment.
- Due to data limitation, the progress towards GES for NIS continues to be uncertain as suggested in the assessment conducted in 2018.

Headline pressures

Human activities associated with the most significant direct pressures from introduction and spread of NIS include maritime traffic, mariculture and aquaculture (aquaculture can

include freshwater and marine species whilst mariculture is limited to marine organisms) and activities introducing artificial hard substrates to the marine environment (e.g. renewable energy and oil and gas related infrastructures). Litter, as well as natural flotsam from marine and terrestrial sources, also provides pathways for NIS to colonise new locations.

Evidence and policy challenges

Although improvements have been made, the lack of comprehensive and quantifiably consistent monitoring across UK waters, remains a significant issue for the robust and accurate assessment of GES with respect to NIS.

- NIS hotspot analysis and DNA-based monitoring for marine NIS would help to address NIS data gaps and support the development of a more robust monitoring strategy in the future.
- Development of improved statistical approaches to quantify changes in the trends in NIS GES indicators, accurately accounting for changes in monitoring efforts between reporting periods, is needed to improve confidence of future assessments.
- The lack of a dedicated NIS data repository, with records verified by experts and agreed reporting workflows, leads to gaps in NIS records, quality control inconsistencies, and delays in reporting.

Likely impacts of climate change

Climate change, primarily ocean temperature increases, is facilitating the introduction, establishment and unaided dispersion of NIS, particularly for warmer water species. Climate change may also lead to changing patterns in international trade and movement, resulting in new pressures in different geographic areas. Resilience of ecosystems to invasive species might also be weakened by climate change. Coastal protection, created to mitigate against sea-level rise due to climate change, such as sea walls and breakwaters, provides additional hard structures and therefore might promote NIS establishment and spread. Hard substrate associated with other artificial structures, such as oil and gas infrastructure and marine renewable energy installations, may also act as stepping stones for the introduction, establishment and spread of NIS.

Commercial Fish and Shellfish (D3)

Status and indicator assessments

Please visit MOAT for the full, detailed Thematic Assessment for Commercial Fish and Shellfish (D3).

The GES status for commercially exploited fish and shellfish stocks integrates the outcome of two indicators, fishing pressure and reproductive capacity. This provides an estimate of the percentage of stocks within safe biological limits, i.e. that are fished at or

below levels associated with maximum sustainable yield and have a biomass capable of producing maximum sustainable yield[4].

The environmental status for commercially exploited fish and shellfish is based on individual stock assessments results using ICES' latest approach and advice on maximum sustainable yield thresholds for each stock, or, where available, national stock assessments; and the aggregation of fishing pressure and reproductive capacity indicators following a conditional method. The progress towards achieving GES is evaluated using the GES criteria below within a 6-year period (the current assessment period) and compared with previous assessment periods.

A total of 120 stocks of UK interest (58 marine quota fish stocks and 62 national non-quota shellfish stocks in the Greater North Sea, Celtic Seas, and those considered widely distributed) were evaluated and compared between periods to assess the progress towards GES. The full list can be found in Annex 1 to this consultation.

Overarching target

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.

Overarching status: partially met

Overall, commercially exploited fish and shellfish have partially met GES across UK waters. By integrating the criteria for both indicators (fishing pressure and reproductive capacity), our assessment (for the period 2016-2021) shows 42% of marine quota fish stocks and 11% of non-quota shellfish stocks have achieved GES. This is an increase of 9% for marine quota and 6% for non-quota shellfish stocks.

Table: Status of commercial fish and shellfish in the Greater North Sea and Celtic Seas, by criteria

Criteria	2019 Target	Status: Greater North Sea	Status: Celtic Seas	Indicator
1: Fishing mortality of commercially exploited fish and shellfish stocks	The fishing mortality rate of populations of commercially exploited marine fish and shellfish stocks of UK interest are at or below levels which can produce the	Partially met	Partially met	Commercial fishing pressure for stocks of UK interest (UK only indicator D3.1)

[4] MSY is maximizing the average long-term yield from a given fish stock while maintaining the stock as productive. ICES considers the yield to be maximized as the part of the catch that is landed, measured in weight.

	maximum sustainable yield.			
2: Reproductive capacity of commercially exploited fish and shellfish stocks	The reproductive capacity of populations of commercially exploited marine fish and shellfish stocks of UK interest are above biomass levels capable of producing the maximum sustainable yield.	Partially met	Partially met	Reproductive capacity of commercially exploited stocks of UK interest (UK only indicator D3.2)

Technical detail for the next cycle

GES overarching target

Populations of commercially exploited fish and shellfish of UK interest are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock.

Criteria	2024 target	Indicator
1: Fishing mortality	The fishing mortality rate of populations of commercially exploited marine fish and shellfish stocks of UK interest are at or below levels which can produce the maximum sustainable yield.	The fishing mortality rate of populations of commercially exploited marine fish and shellfish stocks of UK interest are at or below levels which can produce the maximum sustainable yield. (UK only indicator D3.1)
2: Reproductive capacity of stock	The reproductive capacity of populations of commercially exploited marine fish and shellfish stocks of UK interest are above biomass levels capable of producing the maximum sustainable yield.	The reproductive capacity of populations of commercially exploited marine fish and shellfish stocks of UK interest are above biomass levels capable of producing the maximum sustainable yield. (UK only indicator D3.2)

Trend since 2019:

Quota fish stocks

Overall, considering all UKMS sub-regions, quota fish stocks[5] showed an additional 9% of stocks at GES compared to previous assessment period (2010-2015) and additional 29% when compared to the 2004-2009 assessment period. Unknown status remained for 21% of stocks. The GES increase reflects spawning stock biomass increasing to levels capable of producing MSY and fishing pressure being within safe biological limits.

Quota stocks now at GES include:

- The spurdog stock in the Northeast Atlantic and adjacent waters which benefited increase in their reproductive capacity by managing fishing pressure and from additional data improving the assessment.
- The whiting stock in the North Sea and eastern English Channel; spawning stock biomass increased to levels capable of producing MSY and fishing pressure reduced.
- Several nephrops stocks in the central North Sea (Firth of Forth, Moray Forth) and in the West of Scotland and Irish Sea West; sole stock in the Bristol channel and Celtic Sea, due to the reduction of fishing pressure and stock being within safe biological limits.

In contrast several stocks are now considered not at GES, these include:

- The blue whiting stock in the Northeast Atlantic and adjacent waters due to fishing pressure exceeding levels which can produce MSY.
- The herring stock in the southwest of Ireland, despite very low fishing pressure which might suggest the influence of environmental factors or changes in the ecosystem since no evidence was found for this stock migrating outside its traditional area.

Non-quota shellfish stocks

GES for non-quota shellfish stocks[6] is based on the UK national shellfish stock assessments, which are data-limited assessments covering a reduced number of stocks and years. The most complete set of national non-quota shellfish stock assessments covers the current assessment period from 2013 to 2019. There has been an increase of

[5] The term “quota fish stock” refers to marine fish and shellfish subpopulations of a particular species defined as a harvested unit (stock) for which ICES gives catch advice and fishing is limited by a quota or Total Allowable Catch (TAC) that caps the amount of fish each country is allowed to catch. In most cases these TACs are agreed in international negotiations.

[6] The term “non-quota shellfish stock” refers to marine shellfish subpopulations of a particular species, including both crustaceans (e.g. brown crab and lobster) and molluscs (e.g. scallop and whelk), defined as a harvested unit (stock) for which are national stock assessments report on status and where fishing is not limited by a quota.

6% since 2012, and 10% since 1990 of non-quota shellfish stocks being at GES. However, the status of nearly half of non-quota shellfish stocks remains unknown.

- Additional non-quota stocks now at to GES include: six king scallop stocks, two of which were previously classed as “unknown” and the other four are new stock assessments.
- In contrast several stocks are now considered not at GES, these include one brown crab, one velvet crab and one lobster stock due to fishing mortality being found above safe biological limits, whereas the Shetland brown crab stock changed from ‘met’ to ‘unknown’ status due to data gaps from surveys in adverse weather conditions.

Headline pressures

Many fish stocks in UK waters are shared with other coastal states, primarily the EU, and are jointly managed, principally through annual negotiations, to set Total Allowable Catches (TACs) and other management measures. Through these negotiations, the UK seeks to ensure that fishing for shared stocks occurs within sustainable levels, while balancing the social and economic needs of the fishing industry.

Commercial fishing is the dominant anthropogenic pressure on stocks in both the Greater North Sea and Celtic Seas.

While commercial fishing activities can lead directly to pressures on fish and shellfish populations in terms of mortality rates and extraction of biomass, marine recreational fisheries can also be a source of pressure on some stocks that is less well understood.

Beyond fishing activity, fish and shellfish populations are subject to a wide range of other marine pressures from licensed marine activities such as offshore wind and aggregate dredging, as well as the effects of climate change. These pressures can result in environmental changes to the marine ecosystem, habitats and hydrographical conditions, which can impact fish stocks. Marine ecosystems are also indirectly affected by interactions with other species, changes in marine food web dynamics, and the reduction in prey availability, which can affect fish stocks.

Evidence and policy challenges

- Our key evidence challenge is to improve our monitoring for data limited stocks including non-quota shellfish stocks, and non-quota finfish. Although the number of commercially exploited non-quota shellfish stocks considered to be at GES has increased in 2019, nearly half of those remain unknown. The fisheries for non-quota species (NQS) are primarily managed and surveyed at national and regional levels.
- Monitoring challenges remain, particularly for shellfish which aren’t normally captured by conventional whitefish surveys, some NQS are the subject of FMPs that will initiate and improve the evidence gathering for stock data for these species. FMPs will also be used where NQS stocks are shared with the EU, alongside multi-year strategies which will help to ensure fisheries with these stocks are managed sustainably across their range.
- Additionally, most NQS are data-limited, and many have no existing methodology for MSY equivalent assessment to set sustainable catch limits. Whilst in many cases these

are currently under development, until such assessments exist demonstration of GES will remain challenging for NQS stocks and data-limited stocks.

Other headline challenges include:

- Improving our understanding of key drivers and map specific impact of multiple pressures on UK stocks and the effectiveness of management measures.
- The nature of fishing pressure is varied in its intensity and not limited to UK fleets, and sustainable catch limits are exceeded for some quota stocks.
- The UKs TACs must be agreed internationally which hinders our ability to act (or achieve GES) unilaterally. For shared stocks, other countries could object to management measures we put in place for NQS and any management measures for such stocks must conform to obligations in the TCA to allow them access to fish in our waters.
- Efforts to understand environmental pressures on stocks, restoring and protecting key habitats and ultimately balancing the need to restore the marine environment whilst supporting commercial fisheries to meet societal needs for economic, social and employment benefits.

Likely impacts of climate change

Climate change has several effects on fish and shellfish populations, and fisheries. These include changes of species distribution, migration, spawning behaviour of fish, changes in fishing grounds that will affect fisheries activities, and allocation of quotas across international boundaries.

Distinguishing between climate change impacts and other drivers of impacts on fish stocks remains a challenge. However, stock assessments consider fishing mortality rate and spawning biomass in terms of MSY under existing environmental conditions, including changes in recruitment, growth and biomass of stocks that are influenced by both climate variability and change. Fisheries activities would need to continue adapting to changes in stocks, such as reducing allocation of quotas for stocks with decreasing productivity while fishing other stocks with a biomass capable of producing maximum sustainable yield.

There is evidence that climate variability particularly impacted the recruitment and growth of the cod stocks in the southern area of the North Sea, with the production of young cod in declining in parallel with the increase in the seawater temperature average. As a result, the fishing pressure was reduced as a precautionary measure to allow the stock recovery. However, the stock would still require spawning in suitable temperature conditions to successfully recruit and produce biomass. Increases in seawater temperature would affect differently fish species with preference for cooler or warmer waters that might possibly lead to changes in the timing of reproduction or spawning locations. Fish and shellfish tolerance to changes in climate conditions, ecosystem and food web dynamics varies between stocks.

Marine Food Webs (D4)

Status and indicator assessments

Please visit MOAT for the full, detailed Thematic Assessment for Marine Food Webs (D4).

The determination of the status of food webs has been based on 7 (Greater North Sea) or 6 (Celtic Sea) indicators for each sea respectively. These indicators have been developed to create an overall perspective on the food web.

The GES status for food webs is assessed by integrating the outcome of 7 indicators, pilot assessment of ecological network analysis indices, concentrations of chlorophyll-a, changes in phytoplankton and zooplankton communities, size composition in fish communities, pilot assessment of mean maximum length of fish, proportion of large fish (large fish index) and pilot assessment of feeding guilds.

The assessments of the status of food webs also considers the results described in the sections above on “D1, D4” on fish, marine birds, seals, cetaceans and pelagic habitats. This enables the food web thematic assessment to consider the abundances, distribution and productivity of key groups representing different trophic levels.

Overarching target

The health of the marine food web is not significantly adversely affected by human activities.

Overarching status: not met

Food webs have not met GES across the marine strategy area. Demersal fish communities (species typically feeding or living on or near the seabed) have not achieved GES in either the Greater North Sea (GNS) or Celtic Seas (CS). Plankton community indicators show decreasing productivity trends in the GNS and CS. Change in fish feeding guild biomass was mixed across the GNS and CS with spatially extensive increases in benthivores, increase in piscivore and pisco-crustivore biomass in southern North Sea and CS but decreases in planktivores, pisco-crustivores and piscivores in the northern North Sea.

Table: Status of marine food webs in the Greater North Sea and Celtic Seas, by criteria

Criteria	2019 Target	Status: Greater North Sea	Status: Celtic Seas	Indicator
1: Trophic guild diversity	The species composition and relative abundance of representative feeding guilds are indicative of a healthy marine food web.	Not met	Not met	Pilot Assessment of Feeding Guilds (OSPAR FW7)

2: Trophic guild balance	The balance of abundance between representative feeding guilds is indicative of a healthy food web.	Uncertain	Not used	Pilot Assessment of Ecological Network Analysis Indices (OSPAR FW9)
3: Size distribution	The size structure of fish communities is indicative of a healthy marine food web.	Not met	Not met	Size Composition in Fish Communities (OSPAR FW3)
3: Size distribution	The size structure of fish communities is indicative of a healthy marine food web.	Not met	Not met	Pilot Assessment of Mean Maximum Length of Fish (OSPAR FC3)
3: Size distribution	The size structure of fish communities is indicative of a healthy marine food web.	Not met	Not met	Proportion of Large Fish (Large Fish Index - OSPAR FC2)
4: Productivity	The productivity of each of the representative feeding guilds, characterised by key species, is indicative of a healthy marine food web.	Not met	Not met	Concentrations of Chlorophyll-a (OSPAR E2)
4: Productivity	The productivity of each of the representative feeding guilds, characterised by key species, is indicative of a healthy marine food web.	Not met	Not met	Changes in plankton communities (OSPAR PH1/FW5)

Technical detail for the next cycle

GES overarching target

The health of the marine food web is not significantly adversely affected by human activities.

Criteria	2024 target	Indicator
1: Trophic guild diversity	The species composition and relative abundance of representative feeding guilds are indicative of a healthy marine food web.	- Pilot Assessment of Feeding Guilds (OSPAR FW7)
2: Trophic guild balance	The balance of abundance between representative feeding guilds is indicative of a healthy food web.	- Pilot Assessment of Ecological Network Analysis Indices (OSPAR FW9)
3: Size distribution	The size structure of fish communities is indicative of a healthy marine food web.	- Size Composition in Fish Communities (OSPAR FW3) - Pilot Assessment of Mean Maximum Length of Fish (OSPAR FC3) - Proportion of Large Fish (Large Fish Index - OSPAR FC2)
4: Productivity	Productivity of each of the representative feeding guilds, characterised by key species, is indicative of a healthy marine food web.	- Changes in plankton communities (OSPAR PH1/FW5) - Concentrations of Chlorophyll-a (OSPAR E2)

Trend since 2019

- It was unclear in 2019 whether GES had been achieved, either for fish communities or for the food web, although it was thought that fish communities were recovering.
- We can now ascertain with medium confidence that demersal fish communities are not in good status, either in the Greater North or Celtic Seas particularly in relation to their size-structure and species composition.
- It is likely that the food web status is continuing to decline despite improvements in the status of some fish stocks.
- In the Celtic Sea, changes before 2016, have been driven mostly by fisheries rather than climate change, but in the future warming is increasingly likely to drive changes in the foodweb.

Other trends observed in 2019 are continuing:

- Grey seal abundance and distribution have continued to increase.
- Harbour seals are in a further state of decline.
- Data availability limits our capacity to confidently assess the status of cetaceans, but where good evidence exists the UK picture is mixed.
- Breeding marine bird populations are still not recovering.
- Plankton communities are continuing to change - the pattern is complex with a suggestion of decreasing productivity overall.

Headline pressures

Climate change will drive range-shifts of food web components and their interactions, whilst rising sea levels will require more flood defence infrastructure and alter the habitat of coastal zones. Fishing impacts the upper part of the food web and distorts energy flows by changing predator to prey interactions.

Evidence and policy challenges

Marine food webs (D4) is a compound descriptor. The challenges facing all relevant biodiversity descriptors are therefore also relevant here. A specific challenge for marine food webs will be to:

- Understand and assess – through improved indicators and ecosystem modelling - the cumulative effects of different human pressures and how they are impacting and changing marine food webs.

Likely impacts of climate change

Climate change acts on all aspects of marine food webs, which are finely tuned to their prevailing conditions. Any rapid fluctuations can dramatically alter these delicate interactions, causing changes to cascade throughout the food web.

Marine heatwaves may result in sudden restructuring of food webs allowing colonisation by invasive species with potentially large adverse economic consequences. Ocean acidification may make it harder for species to secrete calcium which is essential for shell development. This could have consequences for shellfish populations and reef structures.

Climate change is expected to affect the production and composition of plankton communities. It is unclear whether food webs will become either more or less productive, but if the latter, trophic pathways may shorten, resulting in predator fish, birds and mammals being at increased risk. Several recent studies come to contrasting conclusions concerning expected changes in primary productivity in the North Sea. How productivity might change in the future remains a key uncertainty and research suggests models currently have low sophistication in representing primary productivity. Further research on key bottom-up processes is needed in the light of conflicting predictions about the impact of climate change on productivity.

Eutrophication (D5)

Status and indicator assessments

Please visit MOAT for the full, detailed Thematic Assessment for Eutrophication (D5).

This cycle of the UKMS assessment examined four eutrophication indicators. Reporting is based on the OSPAR common indicators (2015-2020) assessed for the eutrophication thematic report under the OSPAR QSR, alongside outcomes of the Water Framework Directive (WFD) and respective national water environment regulatory regime assessments for coastal waterbodies (2014-2019).

Overarching target

Human-induced eutrophication is minimised in UK marine waters.

Overarching status: met

Eutrophication has largely met GES in UK seas. The majority (95%) of UK coastal, shelf and oceanic areas are found to be at GES. However, 3% of coastal waterbodies have not achieved GES with a further 2% at risk of not achieving GES into the future due to levels of dissolved nitrogen.

Table: Status of eutrophication in the Greater North Sea and Celtic Seas, by criteria

Criteria	2019 Target	Status: Greater North Sea	Status: Celtic Seas	Indicator
1: Nutrient concentrations	Nutrient concentrations are below the levels which could lead to harmful eutrophication effects.	Partially met due to some coastal waters not achieving GES	Partially met due to some coastal waters not achieving GES	Nutrients: Dissolved Inorganic Nitrogen (DIN) winter nutrient concentrations (OSPAR E1) waterborne nutrient input trends (OSPAR E3) atmospheric nutrient input trends (OSPAR E4)

2: Chlorophyll-a concentrations	Chlorophyll-a concentrations are below levels which could lead to harmful eutrophication effects.	Partially met due to some coastal waters not achieving GES	Partially met due to some coastal waters not achieving GES	Phytoplankton (a multi-metric of chlorophyll-a and plankton abundance) (OSPAR E2 and OSPAR PH2)
3: Dissolved oxygen content	Dissolved oxygen content in coastal waters are above levels which could lead to harmful eutrophication effects.	Met	Met	Dissolved oxygen (OSPAR E2)

Technical detail for the next cycle

GES overarching target

Human-induced eutrophication in UK seas is minimised.

Criteria	2024 target	Indicator
1: Nutrient concentrations	Nutrient concentrations are below the levels which could lead to harmful eutrophication effects.	- Dissolved Inorganic Nitrogen (DIN) (partially covered by common indicator assessment on winter nutrient concentrations – OSPAR E1, and common indicator assessment on waterborne & atmospheric nutrient input trends – OSPAR E3/E4) - Proposed new - Dissolved Inorganic Phosphorus (DIP) - aligns with ambitions under OSPAR (partially covered by common indicator assessment on waterborne & atmospheric nutrient input trends – OSPAR E3/E4)

2: Chlorophyll a concentrations	Chlorophyll-a concentrations are below levels which could lead to harmful eutrophication effects.	Phytoplankton (a multi-metric of chlorophyll-a and plankton abundance) (OSPAR E2 and OSPAR PH2)
3: Dissolved Oxygen content	Dissolved oxygen content in coastal waters is above levels which could lead to harmful eutrophication effects.	Dissolved oxygen (OSPAR E2)
4: Nitrogen and Phosphorus Loads	Total Nitrogen (TN) and Total Phosphorus (TP) loads (where measured) do not exceed the modelled pre-eutrophic conditions with appropriate variability added to the threshold.	- Proposed new - Total Nitrogen (TN) - as required by OSPAR (potential common indicator assessment on total nutrient concentrations – OSPAR E6) - Proposed new - Total Phosphorus (TP) - as required by OSPAR (potential common indicator assessment on total nutrient concentrations – OSPAR E6)
5: Nutrient Ratios	Nutrient ratios are below levels which could harm the plankton community.	Combined indicators
6: Measures of plankton community/change	Demonstrate an acceptable balance of plankton communities that will support ecological functioning, carbon uptake and food web dynamics.	Proposed for development - measures of plankton community/community change (partially covered by OSPAR PH1/FW5)

Trend since 2019

- The eutrophication status of shelf and oceanic areas has not deteriorated since 2015.
- 3% of coastal (within 1 – 3nm) waterbodies have not achieved GES
    - These locations are identified currently within English, Welsh and Northern Irish waters. It is important to note this picture may not be complete as there is mixed confidence in the data provided from across the UK.
    - WFD and national water environmental regulation assessments for the period 2016 – 2021 showed that these 3% of coastal waters were classified as having a status of ‘moderate’ or below for ‘biological elements that are likely to respond to excess nutrient concentrations’, thus not meeting GES.

- Nutrient and chlorophyll levels are increasing for many river plume and coastal waters, suggesting a deterioration of water quality.
- Bottom water dissolved oxygen concentrations remain at GES for the UK river plumes and coastal assessment areas.
- Overall dissolved oxygen status is getting worse, moving away from GES over time.

Headline pressures

Food production and sewage treatment processes are now seen as the major causes of eutrophication, with increasing diffuse (for example via land run off into rivers) and direct or point source (for example via sewage discharge) inputs of dissolved nitrogen and phosphorous entering our seas. Climate change is also affecting the severity of impacts, especially on dissolved oxygen concentrations due to water column stratification.

Evidence and policy challenges

The causes of eutrophication are complex and compound. Our key challenges are to:

- Ensure that Total Nitrogen (TN) and Total Phosphorus (TP) are measured correctly across the UK so we can effectively measure where concentrations exceed modelled pre-eutrophic conditions. This will help us better map trends in dissolved nutrients and determine areas at risk of not achieving GES.
- Effectively quantify changes in plankton communities and link this to eutrophication and pelagic indicators. This will help us understand how eutrophication affects food webs and wider ecosystem functioning and how eutrophication is in turn affected by climate change.
- Ensure nutrient input monitoring (including modelling) is robust to confidently demonstrate effectiveness of relevant measures in tackling eutrophication in coastal areas.
- Explore how to integrate novel and high frequency data, such as Earth Observation satellite data, into traditional monitoring and assessments.

Other challenges include:

- Maintaining alignment with, and contributing to, international commitments such as the United Nations Sustainable Development Goals and OSPAR North-East Atlantic Environment Strategy (NEAES) 2030.
- Exploring better integration of UKMS, OSPAR and WFD (and national water environment) assessment and reporting processes for Coastal waters, including greater harmonisation of indicators and assessment boundaries.

Likely impacts of climate change

Higher annual mean river flow is expected in both the Celtic Seas and the Greater North Sea regions under future climate change scenarios. Increased nutrient loading could be

expected if river discharges increase but loads also depend largely on future land use and socio-economic developments.

There is potential for shifts in the seasonal timing of phytoplankton growth peaks in response to potential climate-driven changes in nutrient inputs and water temperature. This could affect populations of other organisms if growth is misaligned with plankton predator species breeding cycles for instance.

The indirect effects of eutrophication on oxygen concentrations in the near-bottom water layer now show localised but persistent areas of oxygen deficiency in the Greater North Sea. Climate change can impact upon dissolved oxygen concentration in many ways, most evidently via the direct effect of temperature on oxygen solubility (warmer water holds less oxygen). Higher water temperatures can also increase metabolic rates and oxygen demand of marine organisms and increase stratification, which inhibits the supply of oxygenated waters to depth. The seasonal duration of stratification is expected to increase and scale of regions that show oxygen depletion are expected to become larger.

It is also important to consider ocean acidification and its interaction with eutrophication effects, including which species of plankton are more adaptable to acidification.

Hydrographical Conditions (D7)

Status and indicator assessments

Please visit MOAT for a detailed narrative of our approach to Hydrographical Conditions (D7).

No formal assessment of hydrographic conditions (D7) was conducted for this update to the UKMS. We are therefore basing the information below on the same premise as was used for previous assessments (see UK Marine Strategy Part 1 2019).

We will support the planned assessment of D7 for OSPAR Intermediate Assessment 2029 (IA29). We will also keep this descriptor under review and ensure D7 remains aligned with OSPAR and any changes to D7 in the EU Marine Strategy Framework Directive (MSFD). We will update MOAT when this intermediate assessment is available.

Overarching target

The nature and scale of any permanent changes to hydrographical conditions resulting from anthropogenic activities do not have significant long-term impacts on UK habitats and species.

Overarching status: met

Whilst no formal assessment is offered in this consultation, we assert that hydrographical conditions has met GES, based on the same premise presented in the 2019 assessment. This drew on evidence from case studies that examined existing or potential future planning applications. The current regulatory regime continues to be sufficiently robust to ensure that any significant long-term impacts to the criteria listed for this descriptor are mitigated.

Table: Status of hydrographical conditions in the Greater North Sea and Celtic Seas, by criteria

Criteria	2019 Target	Status: Greater North Sea	Status: Celtic Seas	Indicator
1: Permanent alteration of hydrographical conditions	All significant marine infrastructure developments must meet licensing conditions to ensure they do not adversely affect the marine ecosystem.	Met	Met	Whilst this descriptor does not have specific indicators at present, a number of indicators, such as sea surface temperature, salinity, turbidity, species and habitat condition are available to assess the likely impacts of infrastructure developments.

Trend since 2019

- Marine plans, and their associated planning, licensing and consenting regimes, are now complete across England, Scotland, Wales and Northern Ireland.
- In some instances, these marine plans are in the process of being updated: Scotland is preparing a new National Marine Plan (NMP2), England is updating Marine Plan East and Northern Ireland has recently produced a 'Statement of Public Participation' underpinning an update to their two marine plans: inshore and offshore.
- The completion of the marine planning governance frameworks around the UK provides an assurance that hydrographical conditions are being considered at the licensing and consenting stages of the planning process.
- The UK approach to measuring and managing cumulative impacts on hydrographical conditions is in line with advice generated within OSPAR and countries such as the Netherlands.

Likely impacts of climate change

Climate change is having a direct and indirect impact on the hydrographical condition of our seas. Coastal erosion, rising sea temperatures, increased stratification, increased storminess and changes in ecosystem components resulting from altered oceanic currents and conditions are all direct consequences of climate change.

Climate change is also having an indirect impact by driving increased development and industrialisation of the seafloor through our commitment to achieve Net Zero by 2050 (2045 in Scotland), and the accompanying increase in offshore windfarms and associated 'industrialisation' of the seabed.

Contaminants (D8)

Status and indicator assessments

Please visit MOAT for the full, detailed Thematic Assessment for Contaminants (D8).

The state of the environment has not reached GES for some contaminants when concentrations in biota (marine organisms) or the environment (sediment and water) are not significantly below the environmental assessment criteria (EAC) (e.g., environmental thresholds) for risk of environmental harm. For some of these chemicals where concentrations were above environmental thresholds, the ecotoxicological (toxic effects on organisms) evidence suggests that there are no, or only minor, biological impacts.

All indicators apart from 'metals (Hg, Cd, Pb) in biota and sediments' achieve or partially achieve GES. However, this one indicator of non-compliance is sufficient to conclude that GES has not been fully met for D8.

Note: Since the 2019 assessment, there has been a significant change to the way impacts from mercury are measured, transitioning from using a human health standard to an environmental standard. This more stringent environmental threshold provides a better picture of the potential impact of mercury and is in line with thresholds used across the Northeast Atlantic. It means mercury levels across all assessed regions are at concentrations above biological thresholds and at levels that could cause harm to marine life. This would have been the case for previous assessments had the same thresholds been applied. It does not mean there has been a material change in the state of the marine environment between 2019 and now, and it does not mean that mercury levels have increased in the marine environment. What it does, is highlights that an environmental risk remains from contaminants present in the marine environment.

Overarching target

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.

Overarching status: not met

All criteria for contaminant concentrations in UK seas have met or partially met GES, except for contaminant concentrations for four heavy metals (lead, mercury, copper, zinc) and two other persistent pollutants (CB118 and BDE209) which are above environmental thresholds in sediments and/or biota, in at least one assessed biogeographic region. Consequently, overall, UK waters have not met GES for contaminants.

Table: Status of contaminants in the Greater North Sea and Celtic Seas, by criteria

Criteria	2019 Target	Status: Greater North Sea	Status: Celtic Seas	Indicator
1: Concentrations of contaminants in coastal and territorial waters	Concentrations of contaminants measured in water, sediment or marine biota comply with appropriate threshold values.	Not met	Not met	Metals in biota and sediment (OSPAR H1)
1: Concentrations of contaminants in coastal and territorial waters	Concentrations of contaminants measured in water, sediment or marine biota comply with appropriate threshold values.	Partially met	Partially met	PCBs in biota and sediment (OSPAR H2)
1: Concentrations of contaminants in coastal and territorial waters	Concentrations of contaminants measured in water, sediment or marine biota comply with appropriate threshold values.	Met	Met	PAHs in biota and sediment (OSPAR H3)
1: Concentrations of contaminants in coastal and territorial waters	Concentrations of contaminants measured in water, sediment or marine biota comply with appropriate threshold values.	Met	Partially met	PBDEs in biota and sediment (OSPAR H5)
1: Concentrations of contaminants in coastal and territorial waters	Concentrations of contaminants measured in water, sediment or marine biota comply with appropriate threshold values.	Met	Met	Inputs of metals from water and air (OSPAR H13/H14)

1: Concentrations of contaminants in coastal and territorial waters	Concentrations of contaminants measured in water, sediment or marine biota comply with appropriate threshold values.	Met	Met	Radionuclides (UK only)
1: Concentrations of contaminants in coastal and territorial waters	Concentrations of contaminants measured in water, sediment or marine biota comply with appropriate threshold values.	Met	Met	Chemical status in water – wider chemicals (UK only)
2: Health of species and condition of habitats	Biological or ecological effects on sea life due to contaminants are below thresholds agreed by OSPAR.	Met	Met	External fish disease index (partially covered by General Biological Effects - OSPAR H11)
2: Health of species and condition of habitats	Biological or ecological effects on sea life due to contaminants are below thresholds agreed by OSPAR.	Met	Met	7-ethoxyresorufin O-deethlyation (EROD) activity
2: Health of species and condition of habitats	Biological or ecological effects on sea life due to contaminants are below thresholds agreed by OSPAR.	Met	Met	Micronucleus test (UK only)
2: Health of species and condition of habitats	Biological or ecological effects on sea life due to contaminants are below thresholds agreed by OSPAR.	Partially met	Partially met	Liver neoplasm (partially covered by General Biological Effects - OSPAR H11)

2: Health of species and condition of habitats	Biological or ecological effects on sea life due to contaminants are below thresholds agreed by OSPAR.	Partially met	Met	Imposex in dogwhelks (OSPAR H4)
3: Significant acute pollution events	The adverse effects of significant acute significant pollution events on the health of species and on the condition of habitats (such as their species composition and habitats relative abundance) are minimised and, where possible, eliminated. *and* Occurrence and extent of significant acute pollution events are minimised.	Met	Met	Number of spills including oil spills (UK only)

Technical detail for the next cycle

GES overarching target

The UK concentrations of contaminants in water, sediment, or biota are kept within agreed levels, and these concentrations are not increasing; and the effects of contaminants on selected biological processes and taxonomic groups, where a cause/effect relationship has been established, are kept within agreed levels.

Criteria	2024 target	Indicator
1: Concentrations of contaminants in coastal and territorial waters	Concentrations of substances identified within relevant legislation, and international obligations are below the concentrations at which adverse environmental effects are likely to occur.	- Metals in biota and sediment (OSPAR H1) - Metals in biota and sediment (OSPAR H1) - PCBs in biota and sediment (OSPAR H2) - PAHs in biota and sediment (OSPAR H3) - PBDEs in biota and sediment (OSPAR H5) - Inputs of metals from water and air (OSPAR H13/H14) - Radionuclides (UK only) - Chemical status in water – wider chemicals (UK only)
2: Health of species and condition of habitats	The intensity of those biological or ecological effects due to contaminants agreed by OSPAR, as appropriate for UK Marine Strategy Part One purposes, are below the toxicologically based standards.	- External fish disease index (partially covered by General Biological Effects - OSPAR H11) - EROD activity (UK only) - Micronucleus test (UK only) - Liver neoplasm (partially covered by General Biological Effects - OSPAR H11) - Imposex in dogwhelks (OSPAR H4)
3: Impact of significant acute pollution events on species and habitats	Occurrence and extent of significant acute pollution effects, and their impact on biota affected by this pollution, should be minimised through appropriate risk-based approaches.	Number of spills including oil spills (UK only)

4: Occurrence of significant pollution events	Occurrence and extent of significant acute pollution effects, and their impact on biota affected by this pollution, should be minimised through appropriate risk-based approaches.	Number of spills including oil spills (UK only)

Trend since 2019

- 89% of contaminant concentration indicators and 96% of biological effects indicators meet agreed target thresholds in 2019.
- All indicators in this assessment, apart from 'metals in biota and sediments', have been determined to have met, or partially met, GES thresholds. If individual components within indicators are not significantly below the environmental assessment criteria (EAC) in some regions, the indicator is considered as partially met.
- Trends in sediment concentrations and biological impacts for most contaminants remain stable.
- There is a significant decreasing trend for the micronucleus indicator, which in turn suggests a lower risk of fish suffering genetic damage or developing cancer because of exposure to contaminants.

Headline pressures

Contamination by hazardous substances is an environmental pressure, whose source lies in a range of other pressures driven by human activities. The OSPAR QSR 2023 highlighted that the top three drivers globally were power production using non-renewable resources, long-range transport of emissions by air and legacy contamination in sediments. Other key drivers for the UK are related to meeting societal needs for food (production), wastewater increases with population growth, and other manufacturing processes. In Wales especially, the discharge from historical metal mines and their immediate surroundings are a key driver of both legacy and ongoing metal pollution.

Evidence and policy challenges

Our key challenges focus on the development and testing of new indicators and validating appropriate analysis methods. Separate from indicator development, the assessment of GES would be improved by:

- Better understanding why some chemicals that are at higher levels than environmental thresholds do not appear to be having any biological impacts.
- Maintaining review of UK targets, indicators, indicator threshold values, and contaminants of emerging concern in collaboration with OSPAR countries.

Other challenges include:

- Considering further options for the prevention or reduction of discharge and mobilisation of pollutants from land, including the impacts across the land to sea interface.
- Exploring better integration and alignment with the Water Framework Directive and respective national water environment regulatory regimes assessment and reporting processes.

Note: Under the respective national water environment regulatory regimes, Good Status for surface waters is determined by measuring good ecological status out to 1nm (3nm in Scotland) and good chemical status out to 12nm. The Chemical Status (CS) of surface waters is currently classified by assessing measured concentrations of 52 listed priority substances, against their environmental quality standards (EQS); where chemical concentrations are greater than EQS values, 'failing CS' is assigned. Where management measures set under the WFD (and respective national water environment regulatory regimes) apply in the marine environment, and help deliver Good Environmental Status under UKMS, and these should not be duplicated by new measures set under UKMS. However, the same set of substances are not necessarily assessed (or measured) in the same way under the WFD, and respective national water environment regulatory regimes, as needed for UKMS and OSPAR. This can lead to confusion and disparity in assessment outcomes.

Likely impacts of climate change

In general, temperature increases result in higher chemical reaction rates and could lead to higher uptake of contaminants and associated health impacts for marine species. Increased temperature has been shown to affect the ability of pesticides and Persistent Organic Pollutants (POPs) to become airborne. Temperature rise also means more rain, which leads to floods and higher run-offs of metals and POPs from land.

For mercury, increasing temperatures, related increased hypoxia (low oxygen levels), fires, and reduced ocean circulation, may increase methylmercury (a very poisonous form of mercury) production in sediments, leading to higher releases from anoxic (low dissolved oxygen) sediments to the overlying water column. Increased storm frequencies, caused by increasing ocean and sea surface temperatures, could also lead to more erosion (including of coastal and riparian landfills) and disturbance of sediments in coastal waters. This makes it more likely that legacy contaminants will be released into the sea by resuspension of sediment-bound pollutants in these areas.

Climate change could, therefore, outweigh the current measures in place to reduce the inputs of contaminants, especially where historic contaminants are released.

Contaminants in seafood (D9)

Status and indicator assessments

Please visit MOAT for the full, detailed Thematic Assessment for Contaminants in Seafood (D9).

The majority of shellfish samples analysed for this assessment period are from Scottish waters and were subject to Food Standards Scotland (FSS) shellfish monitoring procedures, where live bivalve mollusc production areas must be monitored annually under Regulation 1881/2006. No finfish data was available for this assessment. Although there is obligatory monitoring of contaminants in finfish required under Commission Implementing Regulation (EU) 2019/627, the monitoring undertaken is not suitable for the purposes of this assessment.

The chemicals selected for monitoring are taken from those set out in Regulation 1881/2006, together with those identified by the Food Standards Agency (FSA) and FSS. All results show that, for the shellfish tested, there was a high level of compliance with regulatory thresholds set in legislation.

Overarching target

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.

Overarching status: uncertain

Contaminant concentrations in UK seafood have met GES for shellfish. Recent surveys (2016 – 2020) of contaminant concentrations for hazardous substances only contained data from shellfish collected from harvesting areas. As no fish have been sampled for contaminants in seafood, no GES assessment for fish could be carried out. Therefore, we cannot determine GES for contaminant concentrations in UK seafood for finfish as we have no suitable data for this assessment period (see trends since 2019 for detail).

Table: Status of contaminants in seafood in the Greater North Sea and Celtic Seas, by criteria

Criteria	2019 Target	Status: Greater North Sea	Status: Celtic Seas	Indicator
1: Contaminant concentration 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	Met for shellfish	Met for shellfish	Contaminant concentrations in seafood*

	the public if they exceed current precautionary 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.			Heavy metals (Cadmium, Lead, Mercury)
1: Contaminant concentration 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 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.	Met for shellfish	Met for shellfish	Contaminant concentrations in seafood* Polycyclic aromatic hydrocarbons (PAHs)
1: Contaminant concentration 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 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.	Met for shellfish	Met for shellfish	Contaminant concentrations in seafood* Dioxins and dioxin-like Polychlorinated biphenyls (PCBs)

* This indicator is formed of three sub-elements that are assessed against the relevant criteria in the European Commission Reg 1881/2006.

Technical detail for the next cycle

GES overarching target

Concentrations of contaminants in fish and other seafood caught or harvested for human consumption in UK seas do not exceed the relevant maximum levels listed in retained Regulation 1881/2006 (as amended) or other relevant standards and are not increasing.

Criteria	2024 target	Indicator
1: Contaminant concentrations in seafood	For contaminants where regulatory levels have been set, there should be a high rate of compliance with conventions based on relevant surveys and including samples originating from commercial fishing grounds in the Greater North Sea and the Celtic Seas.	One indicator, composed of several elements. Indicator: Contaminant concentrations in seafood. (UK only) - Concentrations of heavy metals. - Concentrations of PAHs. - Concentrations of dioxins and dioxin-like PCBs

Trend since 2019

- The good status found in 2012 and 2019 has been confirmed once again for shellfish. The assessment confirms the results of previous surveys for contaminants in shellfish, which indicated that contaminant levels in seafood on the UK market do not exceed maximum levels set out in the legislations
- Due to the omission of finfish for this assessment, no direct comparison with the 2019 assessment can be made.
- The lack of finfish data is why this time the assessment is considered ‘partially met’ or ‘uncertain’ overall, as the overarching target requires an assessment of both fish and other seafood (shellfish). It is important to note that the lack of finfish data does not mean that state of contamination in seafood has deteriorated since 2019.

Headline pressures

Contaminants in seafood is both an environmental pressure and human health risk. It is impacted by various other pressures driven by human activities. Some of the key drivers for the UK are related to meeting societal needs for energy, food, materials etc. Associated pressures from such activities which lead to contamination of seafood from hazardous substances reflect those for D8.

Evidence and policy challenges

There is no consistent evidence programme for contaminants in seafood. Assessments are based on best available data, which may change between reporting cycles. Whilst no assessment of finfish has been possible, the FSA and FSS have completed ad-hoc finfish surveys for 2022-23. The 2022-23 FSA survey is due to be published, and FSA are working on another, small finfish survey for 2024-25, the results of which would be available for future assessments.

Our headline challenges are:

- To improve the certainty and reliability of assessments by improving the sampling of shellfish from across the UK, especially in southern and eastern waters.
- To consider how to fill remaining evidence gaps for finfish.

Likely impacts of climate change

Temperature increases result in higher chemical reaction rates and could lead to higher biological uptake of contaminants with associated health impacts for marine species and humans that eat them.

Increased temperatures in general could lead to increased contaminant loads via greater rainfall and higher run-offs of metals and other pollutants from land. Measures described in the UK Marine Strategy Part Three (Programme of Measures), and more specific measures, such as metal mine remediation and reduction of storm overflow discharge, may help mediate these increased risks. Changes to land use and management to adapt to a changing climate could also have implications for run off. For mercury, increasing temperatures, related increased hypoxia, fires, and reduced ocean circulation, may increase methylmercury (a very poisonous form of mercury) production in sediments, leading to higher releases from anoxic sediments to the overlying water columns. Increased storm frequencies could also lead to more coastal erosion (including of coastal landfills) and disturbance of sediments. This makes it more likely for legacy contaminants to be released into the sea.

Climate change could, therefore, outweigh the current measures in place to reduce the inputs of contaminants, especially where historic contaminants are released.

Marine litter (D10)

Status and indicator assessments

Please visit MOAT for the full, detailed Thematic Assessment for Marine Litter (D10).

Marine litter in UK waters is periodically monitored through three common indicators: beach litter, plastic particles in the stomachs of fulmars, and seafloor litter. There is work underway to develop an indicator for microplastics in seafloor sediment which may be ready for implementation within the next assessment cycle.

Overarching target

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.

Overarching status: not met

The UK has not met GES for marine litter. Overall marine litter levels remain high, although we are seeing encouraging reductions in beach litter and plastics found in the stomachs of fulmar. Litter on the seafloor remains high in the Greater North Sea).

Table: Status of marine litter in the Greater North Sea and Celtic Seas, by criteria

Criteria	2019 Target	Status: Greater North Sea	Status: Celtic Seas	Indicator
1: Beach litter	A decrease in the total amount of the most common categories found on surveyed beaches.	Met	Met	Abundance, composition and trends of beach litter (OSPAR BE1
2: Seafloor litter	A decrease in the number of items of litter on the seabed.	Not met	Not met	Seafloor litter surveys using benthic trawls (OSPAR BE2)
3: Floating litter	A downward trend in the number of northern fulmars with more than 0.1g of plastic particles in their stomach.	Met	Not used	Floating litter (by proxy, measuring plastic particles in fulmar stomachs) (OSPAR BE3)

Technical detail for the next cycle

GES overarching target

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.

Criteria	2024 target	Indicator
1: Beach litter	A decrease in the total amount of the most common categories of litter found on surveyed beaches.	Abundance, composition and trends of beach litter (OSPAR BE1)
2: Seafloor litter	A decreasing trend in the probability that litter is collected from the seafloor during surveys.	Seafloor litter surveys using benthic trawls (OSPAR BE2)
3: Floating litter	A downward trend in the number of northern fulmars with more than 0.1g of plastic particles in their stomach.	Floating litter (by proxy, measuring plastic particles in fulmar stomachs) (OSPAR BE3)

Trend since 2019

- Marine litter levels remain high, although there are indications of reduction.
- The last UKMS assessment showed that trends of beach litter were stable in the Celtic Seas but slightly increasing in the Greater North Sea.
- There is a real improvement for beach litter, with the latest assessment showing there have been statistically significant decreases in beach litter and plastic abundance observed in the Greater North Sea and in the Celtic Seas.
- Despite remaining above the OSPAR threshold, the amounts of ingested plastics in fulmar in the Greater North Seas have decreased significantly, meeting the UKMS target of a downward trend.
- For seafloor litter however, the Greater North Sea showed a slight increasing trend in probability that fishing net hauls contain litter.

Headline pressures

Marine litter presents an environmental pressure that has both land-based sources and direct input sources to the marine environment. The OSPAR QSR 2023 highlighted that all social and economic drivers have the potential to influence levels of marine litter. Activities associated with manufacturing, production, packaging, processing, and transportation of food; industrial and domestic activities; and production of other commodities required to meet society's needs, all have the potential to produce litter. Additionally, fishing and aquaculture activities can lead to direct marine litter inputs from lost or abandoned gear.

Evidence and policy challenges

Waste is a devolved matter nationally and each government of the UK is implementing a range of policy measures to address this issue.

Further research could help us to fill the following evidence gaps, and there are ongoing workstreams in OSPAR to address these issues.

- A lack in quantitative data makes it difficult for us to fully understand the impacts (including harm) marine litter causes on the marine environment.
- Further work is needed to understand the effects of climate change on marine litter.
- There is a need to better understand sources, pathways and transport (including transboundary transport) of marine litter. This work includes improving understanding of riverine litter as a source.

Additionally, the indicator targets for marine litter (D10) are not considered specific enough, making it hard to assess progress towards GES.

- While there have been positive signs of decline in marine litter, a greater decline is needed to reduce the impact on environment; more granular targets would better support government to address this.
- There is one amended target suggested for seafloor litter to make this more measurable. This is enabled due to the improved ability to report on trends for this indicator.

Likely impacts of climate change

Climate change influences atmospheric and ocean circulation and may affect some of the pathways for, and retention of, litter. For example, climate change could lead to changes in river flows which could affect the quantities of marine litter entering the marine environment from rivers, and the subsequent distribution and deposition of litter. Additionally, rising sea levels and an increase in extreme weather are more likely to erode coastal and riparian landfills, moving their contents into rivers and the sea. Therefore, climate change may mobilise historical domestic and commercial waste to create 'new' sources of marine litter. However, the exact effects that climate change will have on marine litter are difficult to predict. A further concern is the impact of plastic pollution and climate change acting together, causing combined stressors on ecosystems.

Underwater Noise (D11)

Status and indicator assessments

Please visit MOAT for the full, detailed Thematic Assessment for Underwater Noise (D11).

The impulsive noise indicator was assessed using data collated in the UK Marine Noise Registry (MNR), which primarily covers licensed activities. Activity is recorded in Pulse Block Days (PBD). A PBD occurs when at least one noise event has occurred within a UK oil and gas licensing block on a particular day. Modelled maps of shipping noise were used to assess the continuous noise indicator. These maps are based on acoustic modelling combined with Automatic Identification System (AIS) ship-tracking data, and have been validated using acoustic measurements.

Overarching target

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.

Overarching status: uncertain

The environmental status for underwater noise in UK seas is uncertain. This is because threshold values for GES have yet to be defined. Both underwater noise indicators (impulsive and continuous) show an increasing trend across the assessment period, suggesting our seas are becoming noisier.

Table: Status of underwater noise in the Greater North Sea and Celtic Seas, by criteria

Criteria	2019 Target	Status: Greater North Sea	Status: Celtic Seas	Indicator
1: Safe levels of anthropogenic impulsive sound	Levels of anthropogenic impulsive sound sources are not increasing and do not exceed levels that adversely affect populations of marine animals.	Uncertain	Uncertain	Impulsive sound in the sea.
2: Safe levels of anthropogenic continuous sound	Levels of anthropogenic continuous low-frequency sound are not increasing and do not exceed levels that adversely affect populations of marine animals.	Uncertain	Uncertain	Continuous low frequency sound (ambient noise) in UK seas

Technical detail for the next cycle

GES overarching target

Loud, low- and mid-frequency impulsive sounds and continuous low frequency sounds generated by human activities are reduced to the extent that they do not have adverse effects on marine ecosystems and animals at the population level.

Criteria	2024 target	Indicator
1: Safe levels of anthropogenic impulsive sound	Levels of anthropogenic impulsive sound sources are not increasing do not exceed levels that adversely affect populations of marine animals.	Records of spatial and temporal impulsive sound. To be developed both nationally and together with OSPAR contracting parties. This indicator uses data collated in the UK Marine Noise Registry, which primarily covers licensed activities.
2: Safe levels of anthropogenic continuous sound	Levels of anthropogenic continuous anthropogenic low-frequency sound are not increasing do not exceed levels that adversely affect populations of marine animals.	Records of ambient "continuous" noise. (UK only) Modelled maps of shipping noise will be used to assess continuous noise.

We will also look to develop noise exposure indicators for both impulsive and continuous noise in UK marine protected areas (such as marine mammal Special Areas of Conservation) and other sensitive habitats, consistent with the OSPAR common indicator for the risk of impact from impulsive noise.

Trend since 2019

- The impulsive and continuous noise indicators both show upward trends in activity/noise levels since 2018.
- After initial high reported noise levels due to exceptionally high levels of seismic survey activity in 2015, impulsive noise showed a decreasing trend between 2016 and 2017.
- Since 2017, reported impulsive noise has increased.
- Continuous noise monitoring began in 2018 and so data on trends prior to this are not available.

Headline pressures

Underwater noise is an environmental pressure, arising from a range of human activities. Drivers for the UK include offshore energy production from renewable and non-renewable sources and associated seismic surveys, which are the dominant source of impulsive noise. Other sources include construction activities at the coast and offshore; military activities; shipping, fishing vessels and recreational boating; research activities; and aggregates extraction.

The expansion in development associated with the increase in the installation of offshore windfarms is generating increasing levels of impulsive and continuous noise from construction, survey activity, operation and maintenance.

There may also be an increase in geophysical / seismic surveys for carbon dioxide storage activities, carbon capture use and storage facilities, and noise associated with any decommissioning activity.

Evidence and policy challenges

The status of impulsive and continuous noise is uncertain as thresholds values are yet to be defined.

Headline challenges include:

- Agreement of suitable noise exposure indicators for both impulsive and continuous noise in UK waters at population levels (noise is cross-boundary and affects mobile species), so that quantitative noise targets can be established.

Likely impacts of climate change

Climate change may affect levels of underwater noise and associated impacts on marine environments by altering the physical environment, which in turn result in a modest reduction of the sound absorption properties of seawater (although these effects may be negligible in the relatively shallow seas surrounding the UK). More frequent storm events with higher wind speeds are likely and these will increase ambient noise levels. Sea temperature changes and sea level rise will also affect sound propagation (how sound is transmitted through water) including via changes in stratification.

Marine climate change and ocean acidification

Seagrass meadow in the Isles of Scilly.
© Natural England/Emily Priestly

Climate change and ocean acidification acts as a pressure on almost all the descriptors across the UKMS. Therefore, each thematic assessment for UKMS Part One includes a specific reference to this pressure in the context of each descriptor. For example, the human-induced climate change effects have most directly been identified for the lowest components of the marine food web and ocean acidification may make it harder for organisms to secrete calcium and thus may damage shellfish populations (D3) and reef structures (D1, D6 benthic habitats).

The changes in the prevailing physical and chemical marine environment due to human-induced climate change are already causing changes for marine organisms and their habitats. Across species, these changes can generally be categorised as: (1) habitat loss; (2) shifts in distribution; (3) changes to species composition and food webs; and (4) changes to life history events.

Changes in the physical and chemical environment

The prevailing physical and chemical characteristics of UK seas help to determine the structure and function of our marine ecosystems. While they are not a measure of GES in themselves, these provide the background context within which GES is or is not met. In the UKMS Part One (2019), we were able to provide an update on the prevailing conditions of sea surface temperature (SST), ocean acidification, turbidity (sea-surface suspended sediments), and salinity, but assessment of the impacts of climate change on these conditions, or on GES indicators, was largely out of scope. The prevailing conditions are determined by a range of factors, including natural variability in the Earth's climate system and change because of human activities.

Increasingly, change in the prevailing physical and chemical characteristics of UK waters are being seen, including increased sea temperature, acidification, and reduction in dissolved oxygen. These changes have been documented in several recent Marine Climate Change Impacts Partnership (MCCIP) Science Reviews (see MCCIP Physical Environment[7]).

SST around the UK have generally warmed by around 0.3 °C per decade in the last 40 years, although there are regional variations in trends, with warming rate highest in the southern North Sea. Marine heatwaves (short-lived extremes in temperature) have also increased in occurrence with on average four events more around the British Isles in 2000-2016, compared to 1982-1998 (Cornes et al., 2023). In the future, model simulations indicate a continued warming trend. By the end of the century (2079-2098), average annual mean temperature values are predicted to be 3.11 °C warmer than those in 2000-2019, for a high emissions scenario. This warming trend is expected to be stronger in the shallower region of the North Sea, and weaker in the surface waters of the adjacent North Atlantic.

[7] MCCIP Science Reviews

Consequences for the marine environment

The human-induced climate change effects have most directly been identified for the lowest components of the marine food web. Warming temperatures and increased stratification have almost certainly caused changes to the pelagic habitat (see D1, D4 pelagic habitats), with evidence of declines in key phytoplankton and their zooplankton grazers. These species are important food sources for several fish species and impacts to fish and fisheries are therefore also likely.

For benthic (sea floor) habitats, the intertidal community index (an indicator of SST response on intertidal rock communities as part of the benthic biodiversity component) has shown changes due to warmer temperatures. There is a large volume of evidence of the impacts of human-induced climate change and ocean acidification on benthic habitats (see Benthic Habitats assessment).

Warming seas and ocean acidification will affect contaminants in the marine environment, although great uncertainty remains on the resulting changes in concentrations due to the complex impacts on bioavailability and degradation rates and differences between different chemicals. Changes in the ocean climate will also likely influence the underwater soundscape and the propagation of sound.

Impacts to society

Climate change and ocean acidification create risks and opportunities for the marine ecosystem and the human activities that depend on the ecosystem services it provides. Moreover, the ocean plays an important role in regulating the Earth's climate and a range of natural ocean processes. New uses of the marine space offer opportunities to support reducing the concentrations of greenhouse gases in the atmosphere and therefore reducing impacts of climate change and ocean acidification.

In their recent evidence review the Clean and Safe Seas Evidence Group (CSSEG) noted the potential impacts of climate change and ocean acidification on clean safe seas, and also their potential to limit the effectiveness of the measures set out in the UKMS Part Three. Overall, many knowledge gaps remain that limit the possibility to fully assess the impacts of climate change and ocean acidification.