MSFD Impact Assessment ANNEX B: Assessment of degradation across the different ecosystem components and pressures

Millennium Assessment category	Specific type of ecosystem service	Components/ Pressures	Relevant descriptors
Provisioning services	Fish and shellfish Aquaculture Biofuels Medicines	Fish and Cephalopods	3
Cultural and Recreational Services	Tourism, Nature watching, Recreation, Sport Knowledge Aesthetic benefits / Inspiration Spiritual / Cultural wellbeing	Marine Mammals Fish and Cephalopods Sea birds Intertidal sediment habitats Intertidal rocky habitats Litter (i.e. Litter on beaches affect aesthetic services) Organic enrichment Contamination	1, 3, 4, 5, 8,10 (Impacts of D2 and D11 are indirectly captured through these descriptots)
Regulating services	Climate Regulation Detoxification and purification (regulation of water quality and air quality) Hazard protection (e.g. flood and eroison control) Regulation of disease and pest	Intertidal sediment habitats Intertidal rocky habitats Benthic habitats	1, 6 (Impacts of D2 should be picked up when assessing the degrdadation for 1and 6)
Supporting services	Photosynthesis Nutrient cycling	These are intermediate services that support the final ecosystem services (from which we benefit) and hence not valued.	

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Component/Pressure (policy good)	Measurable sub-category	Assessment under CP2	Predicted status under BAU 2020	GES Target		Difference between preferred GES target and BAU in units from Table 1
				Reasonable confidence	Higher confidence	
Intertidal sediments Recreation on beaches; Natural hazard protection – including species that provide hazard protection (e.g. saltmarsh); Regulating services; Provisioning services (commercial crops such as cockles, oyster/mussel farms)		Along the south-eastern and north-western coasts of England and parts of Wales, intertidal sediments form extensive beaches, sandbanks, saltmarshes and muddy shorelines. In Scotland and Northern Ireland, such stretches of intertidal sediments are often interspersed with rocky promontories and headlands. Human pressures have adversely affected moderate to large areas of these habitats, notably mudflats and saltmarshes, in most of the UK seas apart from those around northern and western Scotland. Historical land claim and the construction of coastal defences and other structures have caused widespread habitat loss, particularly in England. Such structures also affect these habitats by changing current patterns and sediment distribution. In the Southern North Sea and Eastern Channel, the presence of invasive non-native species such as common cordgrass (Spartina anglica) has led to widespread changes to saltmarshes and mudflats. Water quality can affect these habitats and although water quality has improved overall, there are still some small inshore areas where hazardous substances and nutrient enrichment are a problem. Beach litter levels are high in most regions but impacts remain largely unknown. There are also specific local scale issues for specific intertidal sediments.	Littoral course sediment; littoral sand and muddy sand; littoral mud; littoral mixed sediment; coastal saltmarshes and saline reedbeds; intertidal sediments dominated by aquatic angiosperms. For all these habitats there could be a very slight increase in impact from emergence regime changes (hydrological changes to emergence regimes from new tidal barrages, coastal defences or managed realignment), and for littoral sand and muddy sand there could be a very slight increase in pressure from physical change (e.g. changes to physical substrates from the footprint of development). But for all these habitats the area of impact from these pressures amounts to between 0.01% and 0.5% of the habitat. However – assessments for littoral habitats are likely to be low in confidence due to poorly resolved habitat information. In particular, habitats such as intertidal sediments dominated by aquatic angiosperms have not been assessed at all due to gaps in UKSeaMap.	1.4 Habitat distribution • Predominant habitat types - No target proposed – see qualitative target below for 1.6 • All listed (special) habitat types - Range and distribution is stable or increasing and not smaller than the baseline value (Favourable Reference Range for Habitats Directive habitats)	1.4 Habitat distribution • All listed (special) & predominant habitat types - Range and distribution is stable or increasing and not smaller than the baseline value (Favourable Reference Range for Habitats Directive habitats)	GES is probably achieved under the Business As Usual Scenario. This suggests there is no degradation (apart from on a small scale at a local level).
				1.5 Habitat extent • Predominant habitat types – No target proposed – see qualitative target below for 1.6 • All Listed (special) habitat types: o Area is stable or increasing and not smaller than the baseline value (Favourable Reference Area for Habitats Directive habitats) o WFD extent targets for saltmarsh and seagrass	1.5 - Habitat Extent • Predominant habitat types - area of habitat lost, plus area of habitat below GES (as defined by condition indicators) is≤ 10-15%. • All Listed (special) habitat types: o Area is stable or increasing and not smaller than the baseline value (Favourable Reference Area for Habitats Directive habitats)	
				1.6 Habitat Condition and 6.1 Physical damage • Predominant habitat types – Improve the condition of benthic sediment habitats, taking action to reduce impacts where these have been identified as unacceptable. • All Listed (special) habitat types: o Area of habitat below GES (i.e. unacceptable impact / unsustainable use) as defined by condition indicators must not exceed 5% of baseline value (favourable reference area for HD habitats)	1.6 - Habitat Condition and 6.1 - Physical damage • Predominant habitat types - area of habitat lost, plus area of habitat below GES (as defined by condition indicators) is≤ 10-15%. • All Listed (special) habitat types: o Area of habitat below GES (i.e. unacceptable impact / unsustainable use) as defined by condition indicators must not exceed 5% of baseline value (favourable reference area for HD habitats) o WFD targets (km2 thresholds) for area of unacceptable impact for benthic invertebrates,	
Intertidal rocky habitats Recreation; Natural hazard protection; Provisioning services (crops such as seaweeds for alginates, fertilisers, medicines, food). This habitat is highly sensitive to abrasion.		Intertidal rocky habitats, including rocky and boulder shores and sea cliffs, occur in all UK seas. These habitats are generally in good condition. The harvesting of edible shellfish is affecting some local rocky shore biological communities in the Greater North Sea sub-Region and the south-west parts and the Irish Sea in the Celtic Seas sub-Region. Non-native species are also causing adverse effects to rocky shore communities on a local scale. In addition, species composition of intertidal rocky communities in the Western Channel and Celtic Sea region is already impacted by warmer waters due to climate change.	High energy littoral rock; moderate energy littoral rock; low energy littoral rock; littoral biogenic reefs. For all these habitats there could be a very slight increase in impact from emergence regime changes (hydrological changes to emergence regimes from new tidal barrages, coastal defences or managed realignment). But for all these habitats the area of impact from this pressure amounts to between 0.001 and 2.3% of the habitat. At a local scale, the development of tidal range devices may result in significant impacts on some littoral intertidal habitats. Pressures relating to physical change and physical damage were not assessed as being relevant	1.4 - habitat distribution - • All listed (special) and predominant habitat types - Range and	Same as reasonable confidence target	GES is probably achieved under the Business As Usual Scenario. This suggests there is no degradation (apart from on a small scale at a local level).
				1.5 - Habitat Extent - • All listed (special) and predominant habitat types - Area is stable or increasing and not smaller than the baseline value (Favourable Reference Area for Habitats Directive habitats).	Same as reasonable confidence target	
				1.6 - Habitat condition and 6.1 - physical damage • All listed (special) & predominant habitat types - Area of habitat below GES (as defined by condition indicators) must not exceed 5% of the baseline value (Favourable Reference Area for Habitats Directive habitats)	Same as reasonable confidence target	
Marine Mammals Recreation and cultural services	Population and distribution of Grey and harbour seals.	Cetaceans - Taking into account the 2007 Favourable Conservation Status (FCS) assessments of all cetacean species occurring in UK waters, assessment was considered favourable for the five species that are most abundant in UK waters (harbour porpoise, [common] bottlenose dolphin, white-beaked dolphin, fin whale and minke whale). The status of a further six species was unknown due to a lack of suitable abundance estimates. The remaining 17 species are considered rare or vagrant and therefore it is not possible to assess their conservation status in UK waters. Overall, as a group the condition of cetaceans has been assessed as follows: • Greater North Sea sub-Region: good condition in the Northern North Sea (CP2 Region 1) and the Southern North Sea (CP2 Region 2), poor condition in the Eastern Channel (CP2 Region 3) due to historical bycatch • Celtic Seas sub-Region: moderate condition in the Western Channel and Celtic Sea (CP2 Region 4), the Irish Sea (CP2 Region 5) and the Minches and Western Scotland (CP2 Region 6). The status of cetaceans is unknown in the Scottish Continental Shelf (CP2 Region 7) area and offshore waters north and west of Scotland (CP2 Region 8). Most significant pressures likely to be by-catch (trend unclear), contaminants (downward trend), noise (upward trend) and changes in prey abundance -both due to fishing and climate change (trend unknown). Grey seals - Population in 2010 was estimated to be 113,300 (95% CI 93,800-139,700). Populations have been increasing following historic culling, but that increase now levelling off probably due to density dependent factors affecting the population as a whole (probably pup mortality). Harbour seals - UK has large numbers of harbour seas, most notably in regions 6 & 7, but also small populations in eastern England. Population is estimated at 25,936. There have been significant declines in populations in Orkney, Shetland and off the East coast of Scotland (more than 50% since 2001), populations on west coast of Scotland have remained stable. PDV outbreaks have seriously affected populations off the east of England (50%	Increases in anthropogenic underwater noise, particularly as a result of percussive piling during offshore wind farm construction have the potential to affect the distribution of marine mammals, particularly in Region 2 where a high proportion of future offshore wind development is planned. However, the ecological significance of such displacement is currently unclear and this is managed under the current licensing process. Future levels of by-catch are unclear. While collisions between vessels and marine mammals do occasionally occur, the numbers of individuals involved varies between species - for porpoise collision less common than by-catch, for some whale species collision is more common than by-catch (base on stranding scheme data). Pressure from shooting of seals is likely to decrease following legislation implemented earlier this year under the Marine Scotland Act 2010 to require licensing of shooting.	1.1 - Species distribution -In all of the indicators monitored, there should be no statistically significant contraction in the distribution of marine mammals	Same as reasonable confidence target	Difference between GES targets and BAU is hard to assess. It is not possible to say whether there is degradation for cetacean species, although there is likely to be some degradation for harbour seals. Trends in cetacean species are unknown, and although CP2 gave favourable assessment for the 5 most commonly found species (based on FCS assessments), confidence in this assessment was low. Some of the key pressures on mammal speices are likely to decline between now and 2020, but we don't know enough to say what the overall effect would be. The big unknowns include the impact on cetacean distribtions of increases in noise and the impacts on cetacean and seal abundance of changes in availability of prey species (which could be impacted by both fisheries or climate change). Trends in grey seals are positive and it is likely that there is no difference between BAU and GES - so no degradation. Trends in harbour seals are negative, so there is likely to be a difference between BAU and GES and therefore some degradation, although very unclear whether this is due to anthropogenic pressures or natural factors
				1.2 - Population size and 4.3 Abundance/distribution of key trophic groups - In all of the indicators monitored, there should be no statistically significant decrease in abundance of marine mammals	Same as reasonable confidence target	
				1.3 - Population condition - There should be no statistically significant decline in seal pup production and bottlenose dolphin calf production, and mortality of marine mammals due to fishing by-catch should be sufficiently low to not inhibit population size targets being met	Same as reasonable confidence target	
				4.1 - Productivity of key species - There should be no statistically significant decline in seal pup production and bottlenose dolphin calf production	Same as probable certainty scenario	

Commercial Fish Whitefish (Cod,Haddock,Whiting), Monkfish/Anglerfish, Other Demersal Species, Mackerel, Crabs, Nephrops, Other Shellfish Provisioning services	Stocks of elasmobranches like sharks, skates and rays - which are slow to reach maturity and have generally low fecundity are vulnerable and populations have fallen significantly in the last 100 years. The same is true of deep sea species like Orange roughy and Black scabbardfish - as well as eels and sturgeons. What is more, the situation for thse species is not expected to improve in the near future. Stocks of cod in most sea areas remain below full reproductive capacity and in most cases are not harvested sustainably although the situation is improving. Some some stocks of whiting, haddock, plaice, sole, herring and mackerel are doing well (particularly those in the North Sea). Nephrops (the only shellfish species subject to international catch limits) were	The scientific advice from ICES (2010) suggests that there are a number of stocks whose position is improving - including North Sea haddock, whiting, plaice, sole and herring; West of Scotland herring and Nephrops; Celtic Sea cod; and Channel sole - suggesting exploitation is at sustainable levels. However, only some of these eg North Sea haddock and Western Channel sole are being exploited at levels commensurate with MSY and have stocks sizes estimated to be sufficiently high to ensure long-term sustainability. And many stocks particularly those of cod are some way below desirable levels. It is therefore assumed that without the introduction of the Marine Strategy Framework Directive, the reformed CFP would simply prevent any further significant deterioration n fish stocks (and certainly collapse), but will not deliver significant progress in achieving objectives such as the recovery of stocks to support Maximum Sustainable Yield (MSY) across fisheries, or a fully-integrated ecosystem-based management approach to fisheries. This may however be partly due to time lags in stock recovery and impacts from other pressures such as climate change. Recovery plans assume that recruitment will follow a historic relationship between the level of new recruits and the ultimate Spawning Stock Biomass. *This assessment comes from Charting*	Likely to have some degree of degradation in the interim as targets are set such that MSY is not necessarily achieved until 2020. However, those stocks already at or around MSY (eg North Sea haddock) are likely to be maintained at this level through the setting of annual catch and effort limits to keep exploitation rates within the necessary bounds. For other stocks, the CFP will be attempting to effect a gradual transition towards MSY to avoid destabilising the fishing industry. Some will however require more targeted conservation measures (eg closed areas, gear restrictions, etc.) to reflect their particular vulnerability eg elasmobranches deep sea species, etc. And in some cases, supplementary national or regional measures may be required eg to protect inshore stocks like shellfish.	Same as probable certainty scenario		Likely to have degrdation as Targets are set such that MSY is achieved by 2020. Simon can we say anything specific about the individula stocks?
				Same as probable certainty scenario		
Seabirds Recreation and cultural services		The number of seabirds breeding in the UK as a whole increased from around 4.5 million in the late 1960s to 7 million by the end of the 1990s. Of the seabird species breeding in the UK, only northern gannet and great skua have sustained a positive trend in population size since 1969 when comprehensive monitoring of breeding numbers began. Conversely herring gull and roseate tern numbers have declined the most since 1969 – by more than 50%. The mean breeding success of a sample of 21 seabird species was at its lowest levels in 2004, 2005 and 2007 since monitoring began in the mid-1980s. These falls in breeding success have been most acute in black-legged kittiwakes and other species such as common guillemot that rely on sandeels, and especially on the coast of the North Sea. The key pressures on seabirds are thought to be climate-driven changes in the food chain (changes in the North Sea plankton community in the late 1980s caused by rising sea temperatures has led to large reductions in abundance of the zooplankton on which larval fish feed and poor sandeel productivity is associated with warmer sea-surface temperatures) and fisheries (both through reducing availability of key prey species such as sandeel and through by-catch - although the extent of by-catch as a pressure is not known). In addition it should be noted that for decades, some seabirds have benefited from fisheries through food provided at sea by discharging offal and discarding undersize fish and abundance of these scavenging species may have been elevated above levels that naturally occurring food sources could sustain. A subsequent decline in numbers of northern fulmar since the 1990s may be linked to a reduction in fisheries effort. The presence of non-native predatory mammals on inshore and offshore islands limits the distribution and population size of some species, notably those that nest on the ground o in burrows.	Nothing in the BAU scenario specifically relating to seabirds. In terms of changes in the pressures affecting seabirds, climate-related changes are likely to continue, pressure from fisheries is likely to reduce as the CFP moves towards MSY (but unclear how fast this change would happen in the absence of MSFD). The extent of the impact from bycatch on seabirds in UK waters is unknown. Pressure from by-catch is likely to reduce if a European Action Plan on with pressure from Europe to develop a seabird by-catch programme is defined and implemented within the next 10 years.	Species distribution 1.1: No major shifts or shrinkage in the population distribution of marine birds in 75% of species monitored.	Species distribution 1.1: No major shifts or shrinkage in the population distribution of marine birds in 90% of species monitored.	It is considered likely that there is some degradation in relation to seabirds. It is likely that warming sea temperatures resulting from global climate change will continue to have a negative impact on some prey fish species and a continued incidence of poor breeding success and decline in population size of those seabird species that depend on them. Climate change in the long-term will lead to northward shifts in distribution and declines in population size of some species. Under a BAU scenario some of these climate impacts may be mitigated by changes in CFP depending on the extent of their positive impact on prey fish populations. The measures recommended to achieve GES under the targets proposed for birds will collectively mitigate climate impacts to a greater extent than CFP reform alone: a) The attainment of MSY in commercial species sandeel and herring will, if implemented at appropriate regional scales (for the birds) will enhance food availability to local seabird populations.b) the removal of invasive predatory mammals from key seabird colonies will increase the amount of available safe breeding habitat available and enable perhaps greater access during the breeding season to good foraging areas. c) measures to reduce seabird bycatch may lead to an increase in survival rates amongst many species of seabird.
				Population size 1.1 and abundance/distribution of key trophic groups 4.3: Changes in abundance of marine birds should be within individual target levels in 75% of species monitored.	Population size 1.1 and abundance/distribution of key trophic groups 4.3: Changes in abundance of marine birds should be within individual target levels in 90% of species monitored.	
				Population condition 1.3: Annual breeding success of black-legged kittiwakes should not be significantly different, statistically, from levels expected under prevailing climatic conditions (i.e. sea surface temperature); widespread seabird colony breeding failures should occur rarely (i.e. a <5-15% of colonies in no more than three years our of six); and mortality of marine birds due to fishing bycatch and aquaculture should be sufficiently low to not inhibit population size targets being met.	Same as reasonable confidence target	
Subtidal benthic habitats- Climate regulation, detoxification and purification (regulation of water quality and air quality), recreation (diving & fishing), provisioning (food such as fish & shellfish). Supporting services (nutrient cycling, ecological interactions - structural species provide habitat for others).	All benthic habitats are relevant. **Climate regulation** - Biotic and geochemical processes in all predominant benthic habitats are fundamental to the carbon cycle and so implicated in climate regulation. This is nature's equivalent of 'Carbon Capture & Storage'. Some habitats will be more important than others in climate regulation; the total productivity of the habitat and /or the 'production:biomass ratio' might be used as an indicator of that relative importance. **Detoxification and purification**- all predominant habitats can be considered as being instumental in the long term (decadal) bio-remediation of pollution events (e.g. oil spills, fish farms) and the on-going (daily) purification of water through microbial breakdown of pollutants / toxins. Sublittoral & deep sea sediments are a major site of detrital breakdown (purification) and carbon/nutrient recycling. Biogenic reefs are typically built by filter feeding organisms which are instrumenta	**Subtidal rock** - (limited mainly to areas off Scotland) overall, only limited areas of subtidal rocky habitats appear to be directly impacted by human activity. On a local scale, some have been permanently damaged or removed by mobile fishing gears such as bottom trawls, and been lo lost because of construction, coastal infrastructure or disposal of dredged materials. It is recognised that CP2 significantly underestimated the area of subtidal rock in UK waters. More modern maps such as SeaMap2010 show extensive areas of the UK continental shelf as rock. The CP2 assessment of the state of these habitats is probably still valid. **Shallow subtidal sediments**– impacted by several pressures and there is considerable variability in the in the distribution and/or severity of the impacts. Large areas of subtidal sediments in most regions have been adversely affected by mobile fishing gears. At a local scale pressues include damage caused by extraction of aggregates, nutrient enrichment and pollution. Non-native species are spreading in the subtidal coastal areas in most regions. **Shelf subtidal sediments**- the most widespread, frequent and severe source of anthropogenic disturbance on shelf subtidal sediments occurs through disturbance by demersal fishing. Significant areas of shelf subtidal sediment are thought to have been affected in most regions. Because she subtidal sediment habitats are only rarely affected by surface wave action the impacts of demersal fishing are potentially much higher than for comparable fishing on shallower, naturally disturbed sediments. **Deep sea habitats** - Current understanding of deep-sea habitats is limited	Major pressure on benthic habitats up to 2020 is expected to be physical damage through structural and surface abrasion of the seabed from demersal fishing activity (e.g. trawling and dredging). This pressure is more significant than changes to/loss of physical substrates (e.g. from the footprint of construction or aggregate extraction) by an order of magnitude. **Areas of habitats impacted by structural abrasion/penetration from fisheries dredging** - in 2020 most habitat types would be subject to high and medium intensity of impact in less than 2% of the habitat area, the exceptions are subtidal course sediments (where around 10% of the habitat area could be subject to high or medium intensity impact) and subtidal mixed sediments (where around 7% of the habitat area could be subject to medium intensity impact). **Area of habitats impacted by surface abrasion from fisheries demersal trawling**- in 2020 a number of habitat types could be subject to high and medium intensity of impact	1.4 - habitat distribution - see targets above for intertidal sediment and intertidal rock	1.4 - habitat distribution - see targets above for intertidal sediment and intertidal rock	There is likely to be degradation in relation to this component as both CP2 and the BAU scenario suggest that the targets proposed for GES under both the reasonable certainty and higher certainty scenarios are not being met, and are unlikely to be met in 2020 under BAU. Extent of degradation is more significant for predominant sediment habitats than for rock habitats. It is extremely hard to say what impact this degradation would have in terms of changes to the provision of ecosystem services - other than to conclude that it would reduce the capacity of these habitats to provide those services. It should also be noted that these habitats have been subject to these types of pressures for decades, and so the major damage has already been done. Consequently, a BAU scanario would suggest only a marginal change in their (poor) status between now and 2020/2030.
				1.5 - Habitat Extent - see targets above for intertidal sediment and intertidal rock	1.5 - Habitat Extent - see targets above for intertidal sediment and intertidal rock	
				1.6 - Habitat Condition and 6.1 - Physical damage - see targets above for intertidal sediment and intertidal rock	1.6 - Habitat Condition and 6.1 - Physical damage - see targets above for intertidal sediment and intertidal rock	

Litter Aesthetics, recreation and potentially health	Items per kilometre, of different types (hard plastics, polypropylene twine, rope, etc.)	Some problems with beach litter in all sub-divisions within the Greater North Sea and the Celtic Seas sub-Regions where there are systematic surveys. Less info available for northern Celtic sea. CP2 Fig 4.16 – numbe of beach litter items per kilometre.	Increase in recreation compared to CP2, owing to environmental improvements and warmer waters. No assessment of aesthetics possible. In summary, we have assumed that, under the current regulatory regime, litter will continue to be a problem accumulating in coastal areas (indicator 10.1.1) and in the water column (indicator 10.1.2). Litter will continue to affect subtidal and intertidal benthic habitats through smothering and abrasion and affect marine mammals, turtles and fish populations through entanglement and ingestion.	Decreasing trend (where litter levels are shown to be rising or unacceptable) in the number of visible litter items within specific categories/types on the coastline from 2010 levels by 2020.	Overall reduction in the number of visible litter items within specific categories/types on coastlines from 2010 levels to 2020 **(preferred option).**	Given the fact that the BAU report suggests that litter levels on coastlines will continue to increase it can be concluded that there will be degradation in relation to this component when compared both to the reasonable and higher confidence GES target scenarios. The units of degradation to be looked at will be: change in visitor numbers, damages to boats.
				Surveillance indicator to monitor the quantities of litter on the seafloor **(preferred option).**	Decreasing trend (where litter levels are shown to be rising or unacceptable) in the number of visible litter items within specific categories/types on the seafloor from 2010 levels by 2020.	
				Surveillance indicator to monitor trends in plastic found in the contents of fulmars stomachs (in line with the OSPAR Ecological Quality Objective)	Trends in the levels of plastic particles in the stomachs of northern fulmars are moving towards the levels indicated in the OSPAR Ecological Quality Objective.	
Organic Enrichment (Aesthetics)		No assessment done as we will meet GES under GES	No assessment done as we say we will GES under GES	We say we will meet GES under business as usual, so no need to quantify the difference.		No degradation
Contamination (synthetic, non-synthetic and radio-nuclide) (Aesthetics and *peace of mind*)		No assessment done as we say we will achieve GES under BAU	No assessment done as we say we will GES under GES	We say we will meet GES under business as usual, so no need to quantify the difference.		No degradation
Saltmarsh, seagrass, macroalgae and plankton (carbon regulation)		Not assessed under MSFD (please look at text under GES targets)	More of relevant components present in 2020 than in CP2, due to MCZs, but difference expected to be minimal	No target proposed, but monitoring for the proposed indicators would be put in place.	Distribution of plankton community not significantly influenced by anthropogenic drivers	No degradation