

# Marine Strategy Framework Directive Terminology Definitions and Lists

GES4SEAS WP2: Developing the conceptual framework and knowledge base for ecosystem based management

**Task 2.1.** Setting up the state-of-the-art of cumulative pressure impacts and ecosystem management approaches towards achieving Good Environmental Status within the MSFD



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### Scope

The purpose of this document is to support common understanding and coherent use of the Marine Strategy Framework Directive (MSFD) terminology and official reporting lists within the GES4SEAS Project

# 1. Marine Strategy Framework Directive Related Terms and Definitions

The purpose of this table is to support common understanding of terms relating to the Marine Strategy Framework Directive (MSFD) and the GES4SEAS Project. The terms are organized following the DAPSI(W)R(M)<sup>1</sup> scheme (Elliott et al., 2017, 2022). i.e. thematically and not alphabetically. Precedence is given to MSFD official terms and EC/EU official sources with supplementary information provided to add clarity. All definition sources are cited and found in the reference section.

For convenience the terms are listed alphabetically in a second table with identification number to locate the term in the main table.

No.	Term	Definition	Supplemental Information
1	<b>Drivers</b>	Societal basic needs – the qualities and their quantities that humans need from the natural and built environment for health and well-being, e.g. space, food, water, clean air, shelter, energy, comfort, employment, enjoyment and relaxation, education, good mental and physical health. Elliott et al. (2022a).	
2	<b>Activities</b>	Actions (potentially positive or negative) by society in an area or globally - what we do in the natural and built environment to give us the Drivers; actions throughout all stages including creating, operating, using, removing infrastructure; creating an energy supply; obtaining food and water; being cognitive; using material by our presence (air), etc. Elliott et al. (2022a).	Activities may be grouped into a higher grouping of themes, sectors or categories, and may also be subdivided into sub-activities, operations, actions or methods.
3	Activity Footprint	The area, and/or time, based on the duration, intensity and frequency of an activity which ideally, has been legally sanctioned by a regulator in an authorisation, licence, permit or consent, and which should be so clearly defined and mapped in order to be legally-defendable; it should be both easily observed and monitored and attributable to the proponent of the activity. Cormier et al. (2020).	
4	<b>Pressure</b>	Resulting from [human] activities - defined as the mechanisms (as rate processes) of change, in the way in which an activity will change the natural and societal systems, by modifying the structure and functioning of the systems. Elliott et al. (2022a).	The MSFD uses the term ‘pressure’ to relate to the direct physical, chemical and biological consequences of human activities which can lead to adverse environmental impacts. Pressures are described in Annex III Table 2a MSFD as an input, alteration, or extraction in relation to natural conditions. Pressures can be considered in two ways: 1. At source, i.e. close to the activity generating the pressure. This aspect is particularly relevant for setting environmental targets and for measures as

<sup>1</sup> D: Drivers, A: Activities, P: Pressures, S: State change, I(W): Impacts On human Welfare), R(M): Responses (using management Measures)

No.	Term	Definition	Supplemental Information
			<p>these need to focus on reducing the pressures, when needed to achieve or maintain Good Environmental Status (GES). These are pressures on the marine environment.</p> <p>2. At sea, i.e. the level of the pressure in the marine environment to which the different elements of the ecosystem are subject. This aspect is particularly relevant for determining GES (for pressure-based Descriptors) and for assessment of environmental status in relation to GES. The pressures addressed by the GES Decision and this Guidance relate to pressures at sea. EC (2022). Care should be taken as the terms activity, pressure and impact are often conflated or wrongly assumed to be synonymous.</p>
5	Cumulative pressures	Aggregated, collective, accruing, and (or) combined pressures acting at the same space and/or time (Authors Definition)	
6	Stressor	A type of direct or indirect, natural or human related driver that causes undesired change in an ecosystem to any physical, chemical, or biological entity that can induce adverse effects on ecosystems or human health. Adapted from Selkoe et al. (2015).	A combination of activity/development and pressure acting in a potentially negative manner on an ecosystem component. Often used interchangeably for pressure (ICES, 2019a). Also used interchangeably for activities and pressures (Andersen et al., 2020)
7	Endogenous managed pressure	Anthropogenic pressures which originate within management system, i.e. the causes of change can be controlled and their consequences addressed. Borja et al. (2010)	
8	Exogenous unmanaged pressure	Causes of change which have their origin outside of a management system and cannot be controlled by local measures whereas the consequences which occur in the management site are subject to management measures. Based on Borja et al. (2010)	
9	Pressures Footprint	The area and time covered by the mechanism(s) of change resulting from a given activity or all the activities in an area once avoidance and mitigation measures have been employed (the endogenic managed pressures). It does not necessarily coincide with the activity-footprint and may be larger or smaller. It also needs to include the influence and consequences of pressures emanating from outside the management area (the exogenic unmanaged pressures); given that these are caused by wide-scale events (and even global developments) then these are likely to have larger scale (spatial and temporal) consequences. Cormier et al. (2020)	Important considerations for the pressures-footprint include the frequency of the activity as well as the spatial extent and temporal duration.

No.	Term	Definition	Supplemental Information
10	Intensity	The magnitude of a pressure, resulting effect or impact. ICES (2019).	The magnitude of a pressure can have both spatial and temporal dimensions
11	Persistence	The period over which a pressure continues to cause impact following cessation of the activity introducing that pressure. Knights et al. (2015)	
12	Physical Loss	Physical loss is defined as a permanent change of one of the following types (EC, 2022): 1. Sealing of natural substrate by an artificial structure or other allochthonous material. <ul style="list-style-type: none"> <li>• Loss of biogenic substrate.</li> <li>• Seabed change at EUNIS level 2 (e.g. from sand to mud), or morphology or sediment changes at a more detailed level if significant and documented.</li> </ul> 2. A permanent change is defined if one of the following conditions is true: <ul style="list-style-type: none"> <li>• When reversal is only possible by active human intervention (e.g. by coral, seagrass and kelp transplantations, by removal of artificial structures, by sand capping, etc.).</li> <li>• When natural recovery rates exceed 12 years (such as the recovery time of some coral reefs or seagrass beds or the long-lasting effect of hydrographical or substrate change), or</li> <li>• When natural recovery rates are unknown or undocumented but suspected to exceed 12 years.</li> </ul>	
13	Physical Disturbance	Abrasion, removal and deposition result in physical disturbances and may lead to physical loss depending on the intensity and/or persistence of the pressure. Sealing automatically implies physical loss. Any other physical pressures on the seabed that do not correspond to physical loss should be classified as physical disturbance. Such pressures do not induce permanent change since natural recovery, once the pressure has ceased, may be expected without human intervention. EC (2022)	
14	Harmful Algal Blooms (HABs)	HABs refer to a rapid proliferation of phytoplankton species in aquatic ecosystems posing serious risks to human health, environmental sustainability, and aquatic life due to the production of toxins or the accumulated biomass. Katsenevakis (n.d).	Blooms may also refer to macroalgae and, occasionally, colourless heterotrophic protists. Sellner et al. (2003).
15	Alien species	Any live specimen of a species, subspecies or lower taxon of animals, plants, fungi or micro-organisms introduced outside its natural range; it includes any part, gametes, seeds, eggs or propagules of such species, as well as any hybrids, varieties or breeds that might survive and subsequently reproduce. EU (2014).	Further detailed information can be found in Olenin et al. (2017). Alien species is not synonymous with invasive species (see Invasive alien species definition)
16	Invasive alien species	An alien species whose introduction or spread has been found to threaten or adversely impact upon biodiversity and related ecosystem services. EU (2014).	
17	Jellyfish	Cnidaria (true jellyfish: the planktonic stages of three cnidarian classes Hydrozoa, Scyphozoa and Cubozoa), Ctenophora (comb jellies) and Tunicata (Thaliacea and the Appendicularia) are the bulk of gelatinous macrozooplankton and what we commonly call "jellyfish". Boero (2013).	
18	<b>State</b>	The term 'state', in the context of the DPSIR framework and MSFD, refers to the quality/condition of species/habitat/ecosystem elements. This can be determined through measurements in the environment of relevant parameters for such elements; such measurements, by definition, will reflect any impacts (individual and cumulative) to which the element has been subjected. CSWD (2020).	
19	Status	A classification of state among several well-defined categories. It	

No.	Term	Definition	Supplemental Information
	(Ecosystem)	is usually measured against time and compared to an agreed target in EU environmental directives (e.g. HD, WFD, MSFD), or reference condition. Adapted from Maes et al. (2013)	
20	Good Environmental Status (GES)	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. EC (2008).	GES is achieved when physico-chemical (including contaminants, litter and noise) and hydrographical conditions are maintained at a level where the structuring components of the ecosystem are present and functioning, enabling the system to be resistant (ability to withstand stress) and resilient (ability to recover after a stressor) to harmful effects of human pressures/activities/impacts, where they maintain and provide the ecosystem services that deliver societal benefits in a sustainable way (i.e. that pressures associated with uses cumulatively do not hinder the ecosystem components in order to retain their natural diversity, productivity and dynamic ecological processes, and where recovery is rapid and sustained if a use ceases). Borja et al. (2013).
21	Component (Ecosystem)	Constituent elements of an ecosystem, particularly its biological elements (species, habitats and their communities), or of marine waters. CSWD (2020). See Sections 6 and 7, below.	
22	State Change	Change on the natural system (as the ecology and its supporting physico-chemical aspects) – the resultant spatial and temporal changes in the environmental and ecological structure (situation at one time) and functioning (rate processes), the changes in the natural aspects of the supporting and regulating ecosystem services. Elliott et al. (2022a).	
23	Monitoring	Provision of information for an assessment of the environmental status and for an estimate of the distance from, and progress towards GES. EU (2008).	There are many different types of monitoring including: Surveillance monitoring, Condition monitoring, Operational monitoring, Compliance monitoring, Self-monitoring, Check monitoring, Toxicity testing, Investigative monitoring, Diagnostic monitoring and Feedback monitoring. Borja & Elliott (2021), Elliott et al. (2022b).
24	Indicator	In general, an indicator consists of one or several parameters chosen to represent ('indicate') a certain situation or aspect and to simplify a complex reality. CSWD (2020).	Indicators are also used to indicate or track change.
25	Reference Condition	Reference condition describes the state of the environment (or a component) in which there is considered to be no, or very	Different methodologies exist to set reference

No.	Term	Definition	Supplemental Information
		minor, disturbance from the pressures of human activities. This is sometimes referred to as an unimpacted, pristine or natural state, although it is widely acknowledged that no part of the marine environment is likely to be completely free of such influences. CSWD (2020).	conditions. Borja et al. (2012)
26	Environmental Target	A qualitative or quantitative statement on the desired condition of the different components of, and pressures and impacts on, marine waters in respect of each marine region or subregion. EU (2008).	Different methodologies exist to set environmental targets. Borja et al. (2012)
27	Assessment	For the purposes of the MSFD, an assessment is both a process and a product. As a process, an assessment is a procedure by which information is collected and evaluated following agreed methods, rules and guidance. It is carried out from time to time to determine the level of available knowledge and to evaluate the environmental status. As a product, an assessment is a report that synthesizes and documents this information, presenting the findings of the assessment process, typically according to a defined methodology, and leading to a classification of environmental status in relation to the determination of GES. CSWD (2020).	
28	Scale of assessment	The spatial resolution at which environmental status is assessed for the different ecosystem and pressure elements. The GES Decision allows for different scales to be used depending on the Descriptor and elements being assessed. These scales can differ to the scale for determination of GES, which is required to be at regional or subregional level (Article 3(5)). From identification of the appropriate scale for assessment, there is a need to define the specific areas of each region or subregion for subsequent assessment (termed Marine Reporting Units). CSWD (2020).	
29	Sensitivity	Susceptibility of an ecosystem component to a specific pressure. The concept of sensitivity accounts for the ecosystem components recovery potential, resistance and resilience with respect to a certain pressure and related effects. From Stelzenmüller et al. (2018).	The likelihood of change when a pressure (which could be chemical, physical, hydrological or biological) is applied to a species or habitat. It is a function of the ability of the habitat or species to tolerate or resist change (resistance or tolerance) and the rate (or time taken) for it to recover from impact (resilience or recovery). Tillin & Tyler-Walters (2014).
30	Resilience	The ability of an ecosystem or component, such as a habitat, to return to its original state after being disturbed. The recovery period (often measured in months and years) is used to assess sensitivity (to pressures or activities) for management purposes. CSWD (2020).	The degree to which an ecosystem or a part/component of it is able to recover from disturbance without major persistent change. Orians (1974).
31	Recovery	A return to a normal state of health, mind, or strength. The recovery of populations or ecosystems can be as simple increase, standardized or scaled increase, increase towards a specified target, increase to historical or pristine level or recovery of former structure or function. Lotze et al. (2011).	This could be taken to mean a return to a previous unimpacted state or even a pristine state (defined as unimpacted).
32	Tolerance	The ability of an organism to endure unfavourable environmental conditions. EEA (2001).	
33	Resistance	Ability of a receptor to absorb disturbance or stress without changing character. Based on Hollings (1973). Can be a synonym of intolerance.	
34	Vulnerability	The action of a pressure on a receptor, with regard to the	In addition to the ecosystem



No.	Term	Definition	Supplemental Information
	(ecosystem)	extent, magnitude and duration of the pressure. Robinson et al. (2008).	vulnerability as used for the MSFD, vulnerability of a Social-Ecological System is the affinity of the system to changes, determined by both, the exposure to external stresses and shocks and the intrinsic factors that determine the systems' resilience. Lauerburg et al. (2020).
35	Exposure	A measure of the degree to which a receptor is subjected to a pressure to which it is sensitive. Based on Hiscock et al. (1999).	
36	Safe Operating Spaces	An n-hypervolume, with climate and human impacts (e.g., fisheries) as axes or dimensions, where natural ecosystems should be retained to maintain a desirable state of conservation. Ramirez et al. (2021). The concept is applied to guide management actions for example reducing local stressors (i.e., fishing pressure) in highly impacted areas may contribute to maintain communities within a "safe operating space" (SOS), where they remain resilient to climate change. Based on Ramirez et al. (2021)	This may be synonymous with optimal conditions, i.e. the conditions under which an organism, population or community can usually exist without its functioning being compromised.
37	<b>Impact</b>	Impact for the MSFD refers to adverse effects on the environment caused by pressures from human activities. CSWD (2020).	A possible adverse change, influencing or affecting an environmental component, caused by a pressure related to one or more anthropogenic activities. ICES (2019b).
38	Effect	Human activities exert pressures which have effects which may lead to impacts on receptors. So pressure and effect are always coupled so that every pressure has an effect, but not every pressure necessarily leads to an impact. Judd et al. (2015).	The change in an ecosystem receptor resulting from the application of a pressure. ICES (2019a). An effect can be on the natural or human features of the ecosystem.
39	Adverse effect	Environmental impacts that need to be avoided or reduced in order to achieve or maintain GES. CSWD (2020). Synonym of (environmental) impact.	
40	Environmental Impact	Environmental impact is an alteration from natural conditions, whether permanent or temporary, in a physical, chemical or biological aspect of environment state that is considered undesirable (an adverse effect). In applying the GES Decision, this undesirable state (for a GES criterion) is distinguished from the desirable state by a threshold value. CSWD (2020).	
41	Cumulative effect	Aggregated, collective, accruing, and (or) combined ecosystem changes that result from a combination of human activities and natural processes. Scherer (2011). They can be antagonistic, synergistic and additive. Birk et al. (2020).	
42	Cumulative Effects Assessment (Combined Effects Assessment, Cumulative Impact Assessment; In-combination Effects Assessment;	Assessment of ecosystem changes that accumulate from multiple stressors, both natural and manmade. Dubé et al. (2013).	Holistic evaluations of the combined effects of human activities and natural processes on the environment, and constitute a specific form of environmental impact assessments. ICES (2019a).

No.	Term	Definition	Supplemental Information
	Cumulative Pressure and Impacts Assessment)		
43	Effects Footprint	The spatial (extent), temporal (duration), intensity, persistence and frequency characteristics resulting from (a) a single pressure from a marine activity, (b) all the pressures from that activity, (c) all the pressures from all activities in an area, or (d) all pressures from all activities in an area or emanating from outside the management area. They will have adverse consequences on the natural ecosystem components, but also are likely to affect the ecosystem services from which society gains goods and benefits. Hence, the determination of the effects-footprint needs to include the near-field and far-field effects and near- and far-time effects because of the dynamics and characteristics of marine areas and the uses and users of the area. Similarly, the effects-footprints may be larger in extent and more persistent than the causing activity-footprint and the resulting pressures-footprints. They also need to encompass the effects of both endogenic and exogenic pressures operating in that area. Cormier et al. (2020)	The spatial and temporal extent of the effects of pressures arising from an activity. Sometimes implies the magnitude of these effects within the footprint. ICES (2019a). The effects may be near-field (within the immediate vicinity of the pressure) or far-field (at distance as the result of physico-chemical (dispersion) or biological (migrations) features).
44	Threshold value	A value or range of values that allows for an assessment of the quality level achieved for a particular criterion, thereby contributing to the assessment of the extent to which GES is being achieved. EU (2017a).	Acceptable limits determined by society, applied to pressures, effects or impacts and used as a trigger for management measures. Can relate to quality standards, capacities, tipping points. ICES (2019a).
45	Tipping point	Zones of rapid change in a nonlinear relationship between the state of an ecosystem or ecosystem component and intensity of a driver, human activity or pressure. This leads to abrupt transitions beyond a critical level, in which the system is unable to return to the precedent stable stage. Adapted after Selkoe et al. (2015) and Stelzenmüller et al. (2018).	Any situation where accelerating change caused by a positive feedback drives the system to a new state (may be due to a change in state or conditions). van Nes et al. (2016)
46	Impacts on human Welfare	Changes affecting wealth creation, quality of life required to satisfy the Drivers; changes in the results of the provisioning ecosystem services and cultural benefits; positive and negative influences on the human complementary assets/capital to extract societal goods and benefits from ecosystem services. Based on Elliott et al. (2022a).	An ecosystem service is the aptitude an ecosystem has or develops naturally or as consequence of a management action, and that manifests through its own properties (productivity, diversity, stability, quality of its key parameters, etc.), while a societal benefit is the economic or other profitability (emotional, educational, scientific, etc.) that humans obtain from said service or quality (Marcos et al. 2021).

No.	Term	Definition	Supplemental Information
47	Ecosystem Services	<p>Ecosystem services are the final outputs or products from ecosystems that are directly consumed, used (actively or passively) or enjoyed by people. The Common International Classification of Ecosystem Services (CICES) is the 'EU reference' typology for all ecosystem services. CSWD (2020).</p> <p>CICES separates ecosystem services (e.g. fish biomass) from the benefits they can provide to people (e.g. the nutritional value of the fish biomass). Marine ecosystem services are broadly classified in 3 groups: provisioning services (such as food from fish); regulation and maintenance services (such as the sea's ability to absorb greenhouse gases, thus regulating the climate); and cultural services (such as the availability of charismatic marine species to observe or to research). We get many benefits from these services such as nutrition, reductions in anthropogenic CO<sub>2</sub>, and recreation. Haines-Young and Potschin (2018).</p> <p>Supporting services or ecological functions are the underpinning structures and processes that ultimately give rise to ecosystem services. These are not covered in CICES which seeks to identify the final services that link to the goods and benefits that are valued by people. Flows that have an intermediate status are sometimes described as 'intermediate services', which operate alongside 'supporting services', to underpin the output of final services. Haines-Young and Potschin (2018).</p>	Increasingly, Ecosystem Services (ES) have been separated from Societal Goods and Benefits (SG&B) in which the ES relate to the ecological aspects and the SG&B relate to the societal aspects (e.g. Turner & Schaafsma, 2015). Services are conceptually different from benefits because the things considered as services are still part of the ecosystem that generates them. For the benefit to be realised some transformation by human action or perspective that lies outside that ecosystem is needed. Haines-Young and Potschin (2018). ES benefits are therefore now termed societal goods and benefits.
48	Provisioning services	All materials and biota constituting tangible outputs from marine ecosystems. They can be exchanged or traded as well as consumed or used by people (in, e.g., manufacturing). Haines-Young and Potschin (2018).	
49	Regulation and maintenance services	All the ways in which marine biota and ecosystems control or modify the biotic and abiotic parameters defining the environment of people (i.e. all aspects of the 'ambient' environment). These marine ecosystem outputs are not consumed, but they affect the performance of individuals, communities and populations. Haines-Young and Potschin (2018).	
50	Cultural services	All the ways in which marine biota and ecosystems control or modify the biotic and abiotic parameters defining the environment of people (i.e. all aspects of the 'ambient' environment). These marine ecosystem outputs are not consumed, but they affect the performance of individuals, communities and populations. Haines-Young and Potschin (2018).	.
51	<b>Response (using management Measures)</b>	Using management measures (ecology/environment, technological, economic, societal behaviour, governance (politics/policies, administration, legislation), culture, ethics/morals and communication, using stakeholders) as ways of influencing the Drivers and controlling the activities and pressures as the causes of change in order to prevent the consequences of state changes and impacts on welfare; to respond to both the exogenic and endogenic causes and consequences. Elliott et al. (2017, 2022a).	
52	Management Response-Footprint	The area and time covered by the governance means of monitoring, assessing and controlling the causes and consequences involved in the use of the marine environment through public policy-making, marine planning and regulatory processes. The policies, marine plans and technical measures produced by these processes indicate the means of determining if legal controls are satisfied, and of providing information and data to national and supra-national bodies. They focus on the	

No.	Term	Definition	Supplemental Information
		area and/or time covered by the marine management actions and measures (e.g. programme of measures), including the distribution and range of a species. Elliott et al. (2022a)	
53	Ecosystem-based approach (to management)	An 'ecosystem-based approach' or 'ecosystem-based management' is an integrated approach to management of human activities that considers the entire ecosystem including humans. The goal is to maintain ecosystems in a healthy, clean, productive and resilient condition, so that they can provide humans with the services and goods upon which we depend. It is a spatial approach that builds around a) acknowledging connections, b) cumulative impacts and c) multiple objectives. In this way, it differs from traditional approaches that address single concerns e.g. species, sectors or activities. CSWD (2020).	The comprehensive integrated management of human activities based upon the best available scientific knowledge about the ecosystem and its dynamics, in order to identify and take action on influences which are critical to the health of marine ecosystems, thereby achieving sustainable use of goods and services and maintenance of ecosystem integrity (ICES 2003).
54	Programme of Measures	Measures which need to be taken by Member States in order to achieve or maintain GES. These include; input controls, output controls. Spatial and distribution controls, measures to improve traceability, economic incentives, mitigation and remediation tool, communication, stakeholder involvement and raising public awareness. From EC (2008).	

Alphabetical Listing (see identification number for terms in the main table)

No.	Term	No.	Term
2	Activities	17	Jellyfish
3	Activity Footprint	52	Management Response-Footprint
39	Adverse effect	23	Monitoring
15	Alien species	11	Persistence
27	Assessment	13	Physical Disturbance
21	Component (Ecosystem)	12	Physical Loss
50	Cultural services	4	Pressure
41	Cumulative effect	9	Pressures Footprint
42	Cumulative Effects Assessment (Combined Effects Assessment, Cumulative Impact Assessment; In-combination Effects Assessment; Cumulative Pressure and Impacts Assessment)	54	Programme of Measures
5	Cumulative pressures	48	Provisioning services
1	Drivers	31	Recovery
47	Ecosystem Services	25	Reference Condition
53	Ecosystem-based approach (to management)	49	Regulation and maintenance services
38	Effect	30	Resilience
43	Effects Footprint	33	Resistance
7	Endogenous managed pressure	51	Response (using management Measures)
40	Environmental Impact	36	Safe Operating Spaces
26	Environmental Target	28	Scale of assessment
8	Exogenous unmanaged pressure	29	Sensitivity
35	Exposure	18	State
20	Good Environmental Status (GES)	22	State Change
14	Harmful Algal Blooms (HABs)	19	Status (Ecosystem)
37	Impact	6	Stressor
46	Impacts on human Welfare	44	Threshold value
24	Indicator	45	Tipping point
10	Intensity	32	Tolerance
16	Invasive alien species	34	Vulnerability (ecosystem)

## 2. Marine Strategy Framework Directive Descriptors

The individual MSFD Descriptors are defined in EU (2008) with basis type from EU (2022)

No.	Name	Descriptor	Basis (EC, 2022)
1	Biological Diversity	Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions.	Status-based
2	Non-indigenous species	Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystems.	Pressure-based
3	Commercially exploited fish and shellfish	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.	Status-based
4	Marine food webs	All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity.	Status-based
5	Eutrophication	Human-induced eutrophication is minimised, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algae blooms and oxygen deficiency in bottom waters.	Pressure-based
6	Sea-floor integrity	Sea-floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected.	Status-based
7	Hydrographical conditions	Permanent alteration of hydrographical conditions does not adversely affect marine ecosystems.	Pressure-based
8	Contaminants	Concentrations of contaminants are at levels not giving rise to pollution effects.	Pressure-based
9	Contaminants in fish and other seafood	Contaminants in fish and other seafood for human consumption do not exceed levels established by Community legislation or other relevant standards.	Pressure-based
10	Marine litter	Properties and quantities of marine litter do not cause harm to the coastal and marine environment.	Pressure-based
11	Underwater noise and other forms of energy	Properties and quantities of marine litter do not cause harm to the coastal and marine environment.	Pressure-based

### 3. Marine Strategy Framework Directive Descriptors Criteria

The individual Descriptors Criteria are defined in EU (2008) with basis type from EC (2022)

No.	Name	Criteria Elements	Criteria	Primary	Secondary	Information Type (EC, 2022)
1	Biological Diversity	Species of birds, mammals, reptiles and non-commercially-exploited species of fish and cephalopods, which are at risk from incidental by-catch in the region or subregion.	D1C1	The mortality rate per species from incidental by-catch is below levels which threaten the species, such that its long-term viability is ensured.		Impact
		Species groups, as listed and if present in the region or subregion.	D1C2	The population abundance of the species is not adversely affected due to anthropogenic pressures, such that its long-term viability is ensured.		State
		Species groups, as listed and if present in the region or subregion.	D1C3	Primary for commercially-exploited fish and cephalopods and secondary for other species: The population demographic characteristics (e.g. body size or age class structure, sex ratio, fecundity, and survival rates) of the species are indicative of a healthy population which is not adversely affected due to anthropogenic pressures.		State
		Species groups, as listed and if present in the region or subregion.	D1C4	Primary for species covered by Annexes II, IV or V to Directive 92/43/EEC and secondary for other species: The species distributional range and, where relevant, pattern is in line with prevailing physiographic, geographic and climatic conditions.		State
		Species groups, as listed and if present in the region or subregion.	D1C5	D1C5 — Primary for species covered by Annexes II, IV and V to Directive 92/43/EEC and secondary for other species: The habitat for the species has the necessary extent and condition to support the different stages in the life history of the species.		State (species)

No.	Name	Criteria Elements	Criteria	Primary	Secondary	Information Type (EC, 2022)
		Pelagic broad habitat types (variable salinity, coastal, shelf and oceanic/beyond shelf), if present in the region or subregion, and other habitat types as defined in the second paragraph.	D1C6	The condition of the habitat type, including its biotic and abiotic structure and its functions (e.g. its typical species composition and their relative abundance, absence of particularly sensitive or fragile species or species providing a key function, size structure of species), is not adversely affected due to anthropogenic pressures.		State
2	Non-indigenous species	Newly-introduced non-indigenous species	D2C1	The number of non-indigenous species which are newly introduced via human activity into the wild, per assessment period (6 years), measured from the reference year as reported for the initial assessment under Article 8(1) of Directive 2008/56/EC, is minimised and where possible reduced to zero.		Pressure
		Established non-indigenous species	D2C2		Abundance and spatial distribution of established non-indigenous species, particularly of invasive species, contributing significantly to adverse effects on particular species groups or broad habitat types.	Pressure
		Species groups and broad habitat types that are at risk from non-indigenous species	D2C3		Proportion of the species group or spatial extent of the broad habitat type which is adversely altered due to non-indigenous species, particularly invasive non-indigenous species.	State/Impact
3	Commercially exploited fish and shellfish	Commercially exploited fish and shellfish	D3C1	The <i>Fishing mortality</i> rate (F) of populations of commercially-exploited species is at or below levels which can produce the maximum sustainable yield (MSY). Appropriate scientific bodies shall be consulted in accordance with Article 26 of Regulation (EU) No 1380/2013.		Impact



No.	Name	Criteria Elements	Criteria	Primary	Secondary	Information Type (EC, 2022)
		Commercially exploited fish and shellfish	D3C2	The <i>Spawning Stock Biomass</i> (SSB) of populations of commercially-exploited species are above bio mass levels capable of producing maximum sustainable yield. Appropriate scientific bodies shall be consulted in accordance with Article 26 of Regulation (EU) No 1380/2013.		State
		Commercially exploited fish and shellfish	D3C3	The age and size distribution of individuals in the populations of commercially-exploited species is indicative of a healthy population. This shall include a high proportion of old/large individuals and limited adverse effects of exploitation on genetic diversity.		State
4	Marine food webs	Trophic guilds of an ecosystem	D4C1	The diversity (species composition and their relative abundance) of the trophic guild is not adversely affected due to anthropogenic pressures.		State
		Trophic guilds of an ecosystem	D4C2	The balance of total abundance between the trophic guilds is not adversely affected due to anthropogenic pressures.		State
		Trophic guilds of an ecosystem	D4C3		The size distribution of individuals across the trophic guild is not adversely affected due to anthropogenic pressures.	State
		Trophic guilds of an ecosystem	D4C4		Productivity of the trophic guild is not adversely affected due to anthropogenic pressures.	State
5	Eutrophication	Nutrients in the water column	D5C1	Nutrient concentrations are not at levels that indicate adverse eutrophication effects.		Pressure
		Chlorophyll a in the water column	D5C2	Chlorophyll a concentrations are not at levels that indicate adverse effects of nutrient enrichment.		Impact

No.	Name	Criteria Elements	Criteria	Primary	Secondary	Information Type (EC, 2022)
		Harmful algal blooms in the water column	D5C3		The number, spatial extent and duration of harmful algal bloom events are not at levels that indicate adverse effects of nutrient enrichment.	Impact
		Photic limit (transparency) of the water column	D5C4		The photic limit (transparency) of the water column is not reduced, due to increases in suspended algae, to a level that indicates adverse effects of nutrient enrichment.	Impact
		Dissolved oxygen in the bottom of the water column	D5C5 (may be substituted by D5C8)	The concentration of dissolved oxygen is not reduced, due to nutrient enrichment, to levels that indicate adverse effects on benthic habitats (including on associated biota and mobile species) or other eutrophication effects.		Impact
		Opportunistic macroalgae of benthic habitats	D5C6		The abundance of opportunistic macroalgae is not at levels that indicate adverse effects of nutrient enrichment.	Impact
		Macrophyte communities (perennial seaweeds and seagrasses such as fucoids, eelgrass and Neptune grass) of benthic habitats	D5C7		The species composition and relative abundance or depth distribution of macrophyte communities achieve values that indicate there is no adverse effect due to nutrient enrichment including via a decrease in water transparency	Impact
		Macrofaunal communities of benthic habitats	D5C8		The species composition and relative abundance of macrofaunal communities, achieve values that indicate that there is no adverse effect due to nutrient and organic enrichment (D5C8 is a Primary criterion if it replaces D5C5)	Impact
6	Sea-floor integrity	Physical loss of the seabed	D6C1	Spatial extent and distribution of physical loss (permanent change) of the natural seabed.		Pressure
		Physical disturbance to the seabed	D6C2	Spatial extent and distribution of physical disturbance pressures on the seabed.		Pressure

No.	Name	Criteria Elements	Criteria	Primary	Secondary	Information Type (EC, 2022)
		Benthic broad habitat types or other habitat types	D6C3	Spatial extent of each habitat type which is adversely affected, through change in its biotic and abiotic structure and its functions (e.g. through changes in species composition and their relative abundance, absence of particularly sensitive or fragile species or species providing a key function, size structure of species), by physical disturbance.		Impact
		Benthic broad habitat types as listed and if present in the region or subregion, and other habitat types as defined in the second paragraph.	D6C4	The extent of loss of the habitat type, resulting from anthropogenic pressures, does not exceed a specified proportion of the natural extent of the habitat type in the assessment area.		State
		Benthic broad habitat types as listed and if present in the region or subregion, and other habitat types as defined in the second paragraph.	D6C5	The extent of adverse effects from anthropogenic pressures on the condition of the habitat type, including alteration to its biotic and abiotic structure and its functions (e.g. its typical species composition and their relative abundance, absence of particularly sensitive or fragile species or species providing a key function, size structure of species), does not exceed a specified proportion of the natural extent of the habitat type in the assessment area.		State
7	Hydrographical conditions	Hydrographical changes to the seabed and water column	D7C1		Spatial extent and distribution of permanent alteration of hydrographical conditions (e.g. changes in wave action, currents, salinity, temperature) to the seabed and water column, associated in particular with physical loss of the natural seabed.	Pressure
		Benthic broad habitats types or other habitat types	D7C2		Spatial extent of each benthic habitat type adversely affected (physical and hydrographical characteristics and associated biological communities) due to permanent alteration of hydrographical conditions.	Impact

No.	Name	Criteria Elements	Criteria	Primary	Secondary	Information Type (EC, 2022)
8	Contaminants	Specified contaminants	D8C1	a) Within coastal and territorial waters, the concentrations of contaminants do not exceed specified threshold values b) beyond territorial waters, the concentrations of contaminants do not exceed specified threshold values		Pressure
		Species and habitats which are at risk from contaminants.	D8C2		The health of species and the condition of habitats (such as their species composition and relative abundance at locations of chronic pollution) are not adversely affected due to contaminants including cumulative and synergetic effects.	Impact
		Significant acute pollution events involving polluting substances	D8C3	The spatial extent and duration of significant acute pollution events are minimised.		Pressure
		Specified species and benthic broad habitat types	D8C4		The adverse effects of significant acute pollution events on the health of species and on the condition of habitats (such as their species composition and relative abundance) are minimised and, where possible, eliminated.	Impact
9	Contaminants in fish and other seafood	Contaminants listed in Regulation (EC) No 1881/2006.	D9C1	The level of contaminants in edible tissues (muscle, liver, roe, flesh or other soft parts, as appropriate) of seafood (including fish, crustaceans, molluscs, echinoderms, seaweed and other marine plants) caught or harvested in the wild (excluding fin-fish from mariculture) does not exceed specified values		Pressure

No.	Name	Criteria Elements	Criteria	Primary	Secondary	Information Type (EC, 2022)
10	Marine litter	Litter (excluding micro-litter), classified in the following categories (1): artificial polymer materials, rubber, cloth/textile, paper/cardboard, processed/worked wood, metal, glass/ceramics, chemicals, undefined, and food waste.	D10C1	The composition, amount and spatial distribution of litter on the coastline, in the surface layer of the water column, and on the seabed, are at levels that do not cause harm to the coastal and marine environment.		Pressure
		Micro-litter (particles < 5mm), classified in the categories 'artificial polymer materials' and 'other'.	D10C2	The composition, amount and spatial distribution of micro-litter on the coastline, in the surface layer of the water column, and in seabed sediment, are at levels that do not cause harm to the coastal and marine environment.		Pressure
		Litter and micro-litter classified in the categories 'artificial polymer materials' and 'other', assessed in any species from the following groups: birds, mammals, reptiles, fish or invertebrates.	D10C3		The amount of litter and micro-litter ingested by marine animals is at a level that does not adversely affect the health of the species concerned.	Pressure
		Species of birds, mammals, reptiles, fish or invertebrates which are at risk from litter.	D10C4		The number of individuals of each species which are adversely affected due to litter, such as by entanglement, other types of injury or mortality, or health effects.	Impact
11	Underwater noise and other forms of energy	Anthropogenic impulsive sound in water.	D11C1	The spatial distribution, temporal extent, and levels of anthropogenic impulsive sound sources do not exceed levels that adversely affect populations of marine animals.		Pressure
		Anthropogenic continuous low-frequency sound in water.	D11C2	The spatial distribution, temporal extent and levels of anthropogenic continuous low-frequency sound do not exceed levels that adversely affect populations of marine animals.		Pressure

## 4. Marine Strategy Framework Directive Activities List

The Activity Themes and corresponding Activities are listed from EU (2017b).

Theme	Activity
Physical restructuring of rivers, coastline or seabed (water management)	Land claim Canalisation and other watercourse modifications Coastal defence and flood protection Offshore structures (other than for oil/gas/renewables) Restructuring of seabed morphology, including dredging and depositing of materials Extraction of minerals (rock, metal ores, gravel, sand, shell)
Extraction of non-living resources	Extraction of minerals (rock, metal ores, gravel, sand, shell) Extraction of oil and gas, including infrastructure Extraction of salt Extraction of water
Production of energy	Renewable energy generation (wind, wave and tidal power), including infrastructure Non-renewable energy generation Transmission of electricity and communications (cables)
Extraction of living resources	Fish and shellfish harvesting (professional, recreational) Fish and shellfish processing Marine plant harvesting Hunting and collecting for other purposes
Cultivation of living resources	Aquaculture — marine, including infrastructure Aquaculture — freshwater Agriculture Forestry
Transport	Transport infrastructure Transport — shipping Transport — air Transport — land
Urban and industrial uses	Urban uses Industrial uses Waste treatment and disposal
Tourism and leisure	Tourism and leisure infrastructure Tourism and leisure activities
Security/defence	Military operations
Education and research	Research, survey and educational activities

## 5. Marine Strategy Framework Directive Pressures List

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The Pressure Themes and corresponding Pressures are listed from EU (2017b).

Theme	Pressure
Biological	Input or spread of non-indigenous species Input of microbial pathogens Input of genetically modified species and translocation of native species Loss of, or change to, natural biological communities due to cultivation of animal or plant species Disturbance of species (e.g. where they breed, rest and feed) due to human presence Extraction of, or mortality/injury to, wild species (by commercial and recreational fishing and other activities)
Physical	Physical disturbance to seabed (temporary or reversible) Physical loss (due to permanent change of seabed substrate or morphology and to extraction of seabed substrate) Changes to hydrological conditions
Substances, litter and energy	Input of nutrients — diffuse sources, point sources, atmospheric deposition Input of organic matter — diffuse sources and point sources Input of other substances (e.g. synthetic substances, non-synthetic substances, radionuclides) — diffuse sources, point sources, atmospheric deposition, acute events Input of litter (solid waste matter, including micro-sized litter) Input of anthropogenic sound (impulsive, continuous) Input of other forms of energy (including electromagnetic fields, light and heat) Input of water — point sources (e.g. brine)

## 6. Marine Strategy Framework Directive Species Groups

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The Ecosystem components and corresponding Species Groups are listed from EU (2017a).

Ecosystem Component	Species Group
Birds	Grazing birds Wading birds Surface-feeding birds Pelagic-feeding birds Benthic-feeding birds
Mammals	Small toothed cetaceans Deep-diving toothed cetaceans Baleen whales Seals
Reptiles	Turtles
Fish	Coastal fish Pelagic shelf fish Demersal shelf fish Deep-sea fish
Cephalopods	Coastal/shelf cephalopods Deep-sea cephalopods



## 7. Marine Strategy Framework Directive Habitats

The Ecosystem components and corresponding Broad Habitat Types are listed from EU (2017a).

Ecosystem Component	Broad Habitat Type	EUNIS habitat codes (v. 2016)
Benthic	Littoral rock and biogenic reef Littoral sediment Infralittoral rock and biogenic reef Infralittoral coarse sediment Infralittoral mixed sediment Infralittoral sand Infralittoral mud Circalittoral rock and biogenic reef Circalittoral coarse sediment Circalittoral mixed sediment Circalittoral sand Circalittoral mud Offshore circalittoral rock and biogenic reef Offshore circalittoral coarse sediment Offshore circalittoral mixed sediment Offshore circalittoral sand Offshore circalittoral mud Upper bathyal (2) rock and biogenic reef Upper bathyal sediment Lower bathyal rock and biogenic reef Lower bathyal sediment Abyssal	MA1, MA2 MA3, MA4, MA5, MA6 MB1, MB2 MB3 MB4 MB5 MB6 MC1, MC2 MC3 MC4 MC5 MC6 MD1, MD2 MD3 MD4 MD5 MD6 ME1, ME2 ME3, ME4, ME5, ME6 MF1, MF2 MF3, MF4, MF5, MF6 MG1, MG2, MG3, MG4, MG5, MG6
Pelagic	Variable salinity Coastal Shelf Oceanic/beyond shelf	

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An aerial photograph of turbulent water, likely a waterfall or rapids, showing a mix of dark teal and bright white foam. The water is in constant motion, creating a complex, swirling pattern of white and green. The overall tone is a vibrant, slightly desaturated teal.

2022