Draft Descriptor Fiche
D5 - Eutrophication

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INTRODUCTION

The Marine Strategy Framework Directive (MSFD) review will assess the state of play and progress on the different descriptors set out in Annex I to the Directive. The differences between descriptors are important when looking at the physical environment and different ecosystem components, and also when considering coherence with other legislation/policies, coordination mechanisms, and data collection. Describing the current situation of each descriptor as it relates to the strategic objectives of the MSFD review, in particular the evaluation, should result in a clear reference baseline. In addition, a dynamic baseline should be developed, showing how the situation is expected to evolve in respect of the policy framework, scientific developments linked to ongoing efforts, and wider trends such as climate change, markets, and future developments.

These descriptor fiches are the start of collecting that information. They will be used as working documents throughout the review and revised as the framework evolves and data are collected. Each fiche describes the general state of the descriptor, the marine strategy components, and looks forward at upcoming trends and developments.

1 GENERAL

1.1 What is the state of the environment regarding this Descriptor?

Eutrophication is still a major problem in most EU waters[1] with 41 % of the assessed areas identified as problem areas[2]. Detailed trends show that between 1990 – 2017 about 18 % of monitoring stations showed improved trends in nutrient concentrations, and between 2013 – 2017 about 10 % of monitoring stations showed decreasing concentrations[3].

An EEA report[4] published in 2019 summarised the status for all D5 criteria:

- Nutrient concentrations in the water column (D5C1) ≈20 % were assessed as "not good"
- Chlorophyll-a concentration (D5C2) ≈18 % were assessed as "not good"
- Harmful algal blooms (D5C3) ≈10 % were assessed as "not good"
- Photic limit (D5C4) ≈15 % were assessed as "not good"
- Dissolved oxygen concentration in the bottom of the water column (D5C5) ≈62 % were assessed as "not good"
- Opportunistic macroalgae of benthic habitats (D5C6) ≈28 % were assessed as "not good"
- Macrophyte communities of benthic habitats (D5C7) ≈32 % were assessed as "not good"
- Macrofaunal communities of benthic habitats (D5C8) ≈35 % were assessed as "not good"

Of all the assessed areas, most non-problem areas are located offshore while most problem areas are coastal zones near densely populated areas and downstream of catchment areas from agricultural activities[5].

The four marine regions have different sensitivities to nutrient enrichment due to differences in environmental characteristics[6].

[1] SWD(2020) 61 final; Annex IV of the Milieu, ACTeon study to support the evaluation (report forthcoming).
[2] SWD(2020) 61 final.
[3] SWD(2020) 61 final.
[4] Peterlin, M. ed., 2019. *Nutrient Enrichment and Eutrophication in Europe's Seas: Moving Towards a Healthy Marine Environment*. Publications Office of the European Union.
[5] Peterlin, M. ed., 2019. *Nutrient Enrichment and Eutrophication in Europe's Seas: Moving Towards a Healthy Marine Environment*. Publications Office of the European Union.
[6] https://water.europa.eu/marine/state-of-europe-seas/pressures-impacts/nutrient

- The **Baltic Sea** is the most affected basin in terms of nutrient concentrations in the water column, with only 2 % of the assessed areas identified as non-problem areas. Model results show some areas may only reach good eutrophication around 2200[7].
- In the **Black Sea**, reduced nutrient inputs have translated into a 15-20 % reduction in primary production compared with 1992 levels[8]. However, between 1955 and 2015, the oxygenated layer depth decreased from 140 m in 1955 to 90 m in 2015[9].
- In the **North-East Atlantic**, eutrophication has continuously decreased since 1990, but some areas remain sensitive to nutrient inputs[10] - in the North Sea, the southern part and the English Channel are also significantly affected[11].
- The **Mediterranean Sea** is naturally oligotrophic. However, coastal areas can still get affected by eutrophication historically known to be influenced by natural and/or anthropogenic nutrient inputs[12]. However, most of the Mediterranean Sea was assessed as having good or high status under the WFD[13].

1.2 To what extent is the Descriptor well communicated to the public?

Eutrophication is commonly recognised as an issue by the public, within the context of marine pollution, especially in heavily affected areas such as coastal areas of the Baltic Sea. However, this topic does not get as much attention from the general public as biodiversity loss, overfishing or plastic pollution[14]. In addition, there are differences among marine regions, and the public is less aware of eutrophication in the Mediterranean and Black seas, despite the latter being heavily affected by eutrophication[15].

Algal blooms, which are a direct effect of eutrophication, are the most well-known aspect of this descriptor due to their direct impacts on industry and recreational activities[16]. This conclusion is supported by the Milieu/ACTeon study to support the evaluation, which presented issues raised by stakeholders during the MSFD, IMP, and CFP consultations during 2005 – 2008. Only 8 % of the stakeholders consulted, highlighted eutrophication as an issue[17].

1.3 Which main EU policies regulate this Descriptor? Which ones have a strong influence?

EU Legislation:

- The **Water Framework Directive** (2000/60/EC, WFD) aims to achieve good chemical status for all rivers, lakes and transitional as well as coastal waters in the EU (initially by 2015). MSs are to establish river basin management plans and programmes of measures, aiming to ensure *concentrations do not exceed the [nutrient] levels established so as to ensure the functioning of the*

[7] Murray, C. J., et al., 2019, 'Past, present and future eutrophication status of the Baltic Sea', *Frontiers in Marine Science* 6 (DOI: 10.3389/fmars.2019.00002) in https://www.eea.europa.eu/soer/publications/soer-2020.
[8] Yunev, O., et al., 2017, 'Reconstructing the trophic history of the Black Sea shelf', *Continental Shelf Research* 150, pp. 1-9 (DOI: 10.1016/j.csr.2016.08.008) in https://www.eea.europa.eu/soer/publications/soer-2020.
[9] BSC, 2019. State of the Environment of the Black Sea (2009-2014/5), http://www.blacksea-commission.org/SoE2009-2014/SoE2009-2014.pdf, https://water.europa.eu/marine/state-of-europe-seas/pressures-impacts/nutrient.
[10] https://water.europa.eu/marine/state-of-europe-seas/pressures-impacts/nutrient
[11] SWD(2020) 61 final.
[12] UNEP MAP, 2017. Mediterranean 2017 Quality Status Report https://www.medqsr.org/taxonomy/term/1, https://water.europa.eu/marine/state-of-europe-seas/pressures-impacts/nutrient.
[13] European Environment Agency, 2019. The European Environment—State and Outlook 2020: Knowledge for Transition to a Sustainable Europe.
[14] Pellens, N., Boelee, E., Veiga, J.M., Fleming, L.E. and Blauw, A., 2021. Innovative actions in oceans and human health for Europe. *Health Promotion International*.
[15] Peterlin, M. ed., 2019. *Nutrient Enrichment and Eutrophication in Europe's Seas: Moving Towards a Healthy Marine Environment*. Publications Office of the European Union.
[16] Pellens, N., Boelee, E., Veiga, J.M., Fleming, L.E. and Blauw, A., 2021. Innovative actions in oceans and human health for Europe. *Health Promotion International*.
[17] Milieu, ACTeon study to support the evaluation (report forthcoming).

ecosystem[18]. However, the WFD's objectives are not being achieved yet[19], and the new deadline for achieving good status in all EU waters is 2027.

- The **Nitrates Directive** (91/676/EEC) aims to protect water quality by preventing nitrates from agricultural sources from polluting ground and surface waters and by promoting the use of good farming practices. The implementation and enforcement of the Nitrates Directive have significantly reduced nutrient losses from agriculture over the last 30 years[20]. However, water quality data show that the level of implementation and enforcement are still not sufficient to reach the objectives of the Directive[21].
- The **Urban Waste Water Treatment Directive** (91/271/EEC, UWWTD) aims to protect the environment from domestic and a mixture of waste water and industrial discharges[22]. The UWWTD has seen significant progress in collecting and treating waste waters, with overall compliance of 83%. However, the distance to target remains significant and additional efforts are necessary to reach full compliance including renewing infrastructure[23].
- The **Common Agricultural Policy** (CAP) was first established in 1962 and regulates sustainable food production, protecting nature and safeguarding biodiversity. The CAP includes financial support for environmentally friendly farming practices.

EU Strategies/Action Plans:

- The 2019 **European Green Deal**[24] is a growth strategy to transition the EU economy to a sustainable economic model. It aims to restore aquatic ecosystems and attain the goal of zero pollution by 2050, through the following actions/deliverables relevant to D5: The Zero Pollution Action Plan, the Farm to Fork Strategy and the EU Biodiversity strategy[25].
- In 2021 the **EU Biodiversity Strategy to 2030** was adopted. It presents a plan of actions to restore EU biodiversity, reduce pressures on EU ecosystems, and ensure their sustainable management. Regarding eutrophication, actions and commitments aim to reduce nutrient loss from fertilisers by 50 %, resulting in the reduction of fertiliser use by at least 20 %[26].
- The **Farm to Fork Strategy** was adopted in 2020 and sets targets for water pollution from excessively applied nutrients, aiming to reduce nutrient losses by at least 50 % while maintaining soil fertility. This will reduce fertiliser use by at least 20 % by 2030[27].
- The 2021 **Zero Pollution Action Plan** aims to have air, water and soil pollution reduced to levels that are no longer considered harmful to health and natural ecosystems by 2050. It sets targets, and

[18] Directive 2000/60/EC.
[19] Water Director's meeting, 29.11,2018. The future of the Water Framework Directive (WFD) – Water Directors input to the fitness check process on experiences and challenges of WFD's implementation and options for the way forward. Slides available: https://circabc.europa.eu/sd/a/6d96ebfe-a04e-4b2a-b112-b00a8ef47e97/WD2018-2_Session%202_Consultation%20Group.pdf
[20] EC, 2019. Report from the Commission to the council and the European Parliament on the implementation of Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources based on Member State reports for the period 2016-2019, COM(2021) 1000 final.
[21] EC, (2019). Report from the Commission to the council and the European Parliament on the implementation of Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources based on Member State reports for the period 2016-2019, COM(2021) 1000 final.
[22] Directive 91/271 /EEC.
[23] EC, Directorate-General for Environment, Fribourg-Blanc, B., Dhuygelaere, N., Madec, C., et al., 2022. *11th technical assessment on UWWTD implementation*, Publications Office of the European Union, https://data.europa.eu/doi/10.2779/915400
[24] https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en#documents
[25] Charveriat C. and Holme C. 2021. European Green Deal Barometer 2021. Institute for European Environmental Policy and GlobeScan, Brussels and Paris.
[26] EC, 2021. EU Biodiversity Strategy for 2030 https://ec.europa.eu/info/files/communication-eu-biodiversity-strategy-2030-bringing-nature-back-our-lives_en.
[27] COM(2020) 381 final.

key actions for 2021-2024 to complement other Green Deal initiatives, including a target of reducing nutrient losses by 2030[28].

- The **Mission Starfish 2030** aims to know, restore and protect ocean and waters by 2030. By 2025, the Mission aims to i) Identify EU agricultural subsidies subject to compliance with the rate of use of (in)organic fertilisers to reduce eutrophication; ii) 100 % of urban wastewater in designated coastal areas is subject to tertiary (advanced) treatment; iii) 100 % of wastewater in rural areas is collected and treated. By 2030 to ensure i) Losses of nutrients into the environment are reduced by at least 50 %; ii) the use of fertilisers is reduced by at least 20 %; iii) 100 % of urban wastewater is subject to tertiary (advanced) treatment; iv) All waste water from ships operating in European waters is delivered to treatment plants on land[29].

Other less relevant policies:

- **Industrial Emissions Directive** (Directive 2010/75/EU)
- **Aquaculture guidelines**[30]
- **Floods Directive** (Directive 2007/60/EC)

International level:

The 2015 **UN Sustainable Development Goals** (SDG) set a specific objective to reduce marine nutrient pollution, in particular from land-based activities by 2025[31].

Regional level:

- **HELCOM Baltic Sea Action Plan** (BSAP) was updated in 2021 and lists specific objectives to combat eutrophication: i) concentrations of nutrients close to natural levels; ii) clear waters; iii) natural level of algal blooms; iv) natural distribution and occurrence of plants and animals; v) natural oxygen levels. To achieve these objectives the BSAP identifies Maximum Allowable Inputs (MAI) and Nutrient Input Ceilings (NIC) for all sub-basins[32].
- **OSPAR NEAES 2030** was agreed upon in 2021. Specific Objective 1: Tackle eutrophication by setting environmental targets i) By 2022 OSPAR will implement a eutrophication assessment tool to deliver harmonised and transparent assessments for OSPAR and the MSFD; ii) By 2022 determine the maximum inputs of nutrients for relevant assessment areas; iii) By 2024 identify and quantify relevant sources and agree on nutrient reduction needs for each CP; iv) By 2028 ensure that sufficient measures are taken to achieve the necessary input reductions; v) By 2030 ensure that nutrient reduction targets and measures are sufficient to avoid adverse eutrophication effects in a changing climate; and vi) By 2030 develop and implement a regional approach to applying nature-based solutions to reinstate and safeguard the natural capacity of the ecosystem to sequester nutrients[33].
- The **Black Sea Commission Strategic Plan** for the Environmental Protection and Rehabilitation of the Black Sea (BSP) was adopted in 2009. The BSP sets a list of Long-term Ecosystem Quality Objectives (EcoQOs) such as: reduce eutrophication and ensure good water quality for human health, recreational use and aquatic biota. To achieve these overall objectives, targets and actions are identified (section 3.3 of the BSP, targets 29-46)[34].
- The **Barcelona Convention** addressed eutrophication in its Ecological Objective 5 (EO 5): *Human-induced eutrophication is prevented, especially adverse effects thereof, such as losses in biodiversity,*

[28] COM(2021) 400 final.
[29] EC, 2020. Mission Starfish 2030: restore our Ocean and Waters, https://research-and-innovation.ec.europa.eu/knowledge-publications-tools-and-data/publications/all-publications/mission-starfish-2030-restore-our-ocean-and-waters_en
[30] https://oceans-and-fisheries.ec.europa.eu/ocean/blue-economy/aquaculture/aquaculture-guidelines_en.
[31] Eurostat, 2022. Sustainable development in the European Union. Monitoring report on progress towards the SDGs in an EU context.
[32] HELCOM, 2021. Baltic Sea Action Plan Update.
[33] OSPAR, 2021. Strategy of the OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic 2030.
[34] http://www.blackseacommission.org/Official%20Documents/Black%20Sea%20Strategic%20Action%20Plan%202009/#/BSSAP2009.

ecosystem degradation, harmful algal blooms and oxygen deficiency in bottom waters[35]. The protocols of the Barcelona Convention require contracting parties to take into account the risk of eutrophication and substances which may cause eutrophication when preparing action plans and programmes of measures[36]. In December 2021 CPs adopted the Regional Plan on the UWWT and sewage sludge management in the framework of Article 15 of the Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources (the 'LBS Protocol')[37].

1.4 How are data collected now? To what extent are data available in national/regional/EU databases?

Many of the data relevant to D5 are also collected and reported under the WFD. For the MSFD the most commonly-used primary criteria are nutrient concentrations (D5C1), chlorophyll-a concentration (D5C2), and dissolved oxygen concentration (D5C5).

- Oceanographic parameters linked to D5 such as chlorophyll-a, and oxygen and Nutrient concentrations are available from the ICES database (based on Member State's reported information).
- The EEA uses eutrophication data from RSCs as well as from EU MSs to produce classifications of the eutrophication status in European using the HEAT+ tool.
- The EMODnet-chemistry portal hosts a database on eutrophication in European seas storing data on eutrophication including concentrations of chl-a, nutrients, oxygen and organic matter in all EU basins.

The North and the Baltic seas are more harmonised than the Mediterranean and Black seas, although there has been some effort to improve[38]. For example, eutrophication assessment data based on a list of indicators (relevant for D5 criteria) have been developed based on monitoring data from HELCOM Contracting Parties. Similarly, the OSPAR Data portal (odims) hosts eutrophication assessments for the OSPAR marine region. For the Mediterranean Sea, the MED POL database under the Barcelona Convention hosts chlorophyll-a and nutrient concentration data provided by the Convention CPs. However, these data are not publicly accessible. No regional database related to D5 is available for the Black Sea region.

2 MARINE STRATEGY COMPONENTS

2.1 How is GES currently defined in relation to this descriptor? Have TVs been set and are they regionally coherent? (Article 9 MSFD)

GES is described as "*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*"[39]. The Article 12 assessment on Member States' reported information[40] found that for D5, primary criteria are used and reported coherently by most MSs across all marine regions (over 90 % of MSs in each region report GES determinations for primary criteria). Fewer MSs reported determinations for secondary criteria, and these were not very coherent within each marine region. In addition, the reported qualitative determination of GES was assessed as very good or good for 70 % of MSs for D5. In the North East Atlantic and the Baltic Sea just over half of the MSs reported GES determinations coherent with other MSs in the region (56 % and 52 % respectively). In the Mediterranean, only 31 % of the MSs defined similar qualitative GES determinations.

According to the 2017 GES Decision, TVs are to be set accordingly: (a) in coastal waters, the values set in accordance with Directive 2000/60/EC; (b) beyond coastal waters, values consistent with those for coastal

[35] https://www.medqsr.org/eutrophication-eo5
[36] United Nations Environment Programme, 2019. Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean and Its Protocols.
[37] COM(2021) 678 final.
[38] For example, under the Barcelona Convention, several projects have been developed to establish regional harmonisation when it comes to assessing and reporting on GES. Such efforts are not necessarily descriptor-specific.
[39] Commission Decision (EU) 2017/848.
[40] EU Overview of the Commission assessment of the Member States' reported information to the Commission on the implementation of the MSFD, report forthcoming.

waters under Directive 2000/60/EC. Member States shall establish those values through regional or subregional cooperation[41].

Generally, the method for setting TVs for D5 is well developed[42].

D5 Criterion	Compartment	Agreed threshold methods	TVs available	Comments	Related regulations
D5C1	Coastal waters	Nutrient concentration in surface water or in the water column	From 10 to 13 MS reported TVs for the different nutrient categories	Strong input of WFD in coastal waters, some MS TVs still missing, especially in the open sea.	WFD
	Open sea		From 7 to 14 MS reported TVs for the different nutrient categories		
D5C2	Coastal waters	Chlorophyll-a in the water column	15 MS reported TVs	Strong input of WFD in coastal waters.	WFD
	Open sea		17 MS reported TVs		
D5C3	Coastal waters	Harmful algal blooms in the water column	Only Baltic MS reporting a cyanobacteria bloom index	No index (e.g. red tides) in other marine regions	
	Open sea				
D5C4	Coastal waters	Photic limit (transparency) of the water column	11 MS reported TVs		WFD
	Open sea		11 MS reported TVs		
D5C5	Coastal waters	Dissolved oxygen at the bottom of the water column	12 MS reported TVs	For some regions, TVs from project results and WFD are combined with expert evaluation. D5C5 may be substituted by D5C8.	WFD
	Open sea		14 MS reported TVs		
D5C6	Coastal waters	Opportunistic macroalgae of benthic habitats	3 MS reported TVs		WFD
	Open sea		None		

[41] Commission Decision (EU) 2017/848.

[42] Vasilakopoulos P., Palialexis A., Boschetti S.T., Cardoso A.C., Druon J.-N., Konrad C., Kotta M., Magliozzi C., Palma M., Piroddi C., Ruiz-Orejón L.F., Salas-Herrero F., Stips A., Tornero V., Hanke G. *Marine Strategy Framework Directive, Thresholds for MSFD Criteria: state of play and next steps*, EUR, Publications Office of the European Union, Luxemburg, 2022.

D5C7	Coastal waters	Macrophyte communities of benthic habitats	5 MS reported TVs	Availability of TVs across regions is challenging	WFD
	Open sea		None		
D5C8	Coastal waters	Macrofaunal communities of benthic habitats	9 MS reported TVs	Availability of TVs across regions is challenging	WFD
	Open sea		None		

The Commission's assessment on MS reporting for the second cycle found that over 70 % of MSs have set quantitative values for more than 75 % of the criteria that required values for D5. When assessing the regional coherence of the reporting, it was found that 56 % of MSs in the Baltic Sea region used TVs set at EU or regional level, for the North East Atlantic only 34 % of the MSs used TVs set at EU or regional level while for the Mediterranean sea it was only 30 % of the MSs[43].

In the second reporting cycle, MSs in the North East Atlantic reported TV developed by OSPAR. Other RSCs had not developed TVs, so in the remaining marine regions assessed, MSs reported TVs from the WFD and/or those set at a national level[44]. Given TV are clearly set out in the WFD for coastal waters, TV values are fairly well developed for coastal waters; however, it was noted that improvements are needed for TVs beyond coastal waters[45].

2.2 What targets exist for this Descriptor? are those targets regionally coherent? (Article 10 MSFD)

The Commission's Article 12 assessment on MS reporting under Article 10[46] assumed that in order to be operational, an environmental target must specify the pressures and impacts addressed and quantify the amount of reduction needed to achieve GES. The Commission's assessment of MS reporting found that for Article 10, only 30 % of MSs established measurable targets for D5.

Several targets exist for eutrophication outside the MSFD. While several wider eutrophication-specific targets are in place (see box 1.3), there are several which relate specifically to the criteria[47]:

- EU legislation
  - Zero Pollution Action Plan: Reduce by at least 50% nutrient losses (D5C1)
- Regional
  - OSPAR NEAES: limiting inputs of nutrients and organic matter to levels that do not give rise to adverse effects on the marine environment by 2030 (D5C1)
  - HELCOM BSAP: Natural level of algal blooms by 2030 (D5C2)
  - HELCOM BSAP: Natural oxygen levels by 2030 (D5C5)

Current international and EU level targets from other policies lack precise reduction and sometimes specific deadlines.

2.3 How are marine waters currently assessed? Is GES achieved/not achieved? (Article 8 MSFD)

As part of Article 8 reporting, MSs reported whether GES was achieved for D5 in each marine reporting unit. Information from the second cycle (reported in 2018) shows that for D5 GES is achieved in less than 5 % of the assessments carried out under Article 8, and more than 50 % of the MS assessments indicated that GES for D5 will be achieved only after 2020[48].

[43] EU Overview of the Commission assessment of the Member States' reported information to the Commission on the implementation of the MSFD, report forthcoming.
[44] WISE Marine Article 8 reports 2018, https://water.europa.eu/marine/data-maps-and-tools/msfd-reporting-information-products/ges-assessment-dashboards/general-dashboards
[45] Peterlin, M. ed., 2019. *Nutrient Enrichment and Eutrophication in Europe's Seas: Moving Towards a Healthy Marine Environment*. Publications Office of the European Union.
[46] EU Overview of the Commission assessment of the Member States' reported information to the Commission on the implementation of the MSFD, report forthcoming.
[47] Taken from the target mapping exercise undertaken as a preliminary step for this descriptor fiche
[48] SWD(2020) 61 final.

2.4 To what extent are measures appropriate? Are they regionally coherent? What is the status of the implementation of the Programmes of Measures (PoMs)? (Articles 13 and 18 MSFD)

The Commission assessment of the reporting for the first cycle (2015) of the PoMs indicates that approximately 74 % of the reported measures for D5 are existing measures (mostly from the WFD)[49]. This suggests that most MSs consider the measures implemented under their RBMPs are sufficient to address eutrophication in the marine environment. MSs also report measures stemming from the UWWTD, the Nitrates Directive, Industrial Emissions Directive, the Floods Directive and the RSCs[50]. The new measures in the first cycle aim to reduce nutrient inputs into the marine environment by optimising agricultural management, establishing NOx emissions control areas for shipping, supporting sustainable aquaculture practices and developing port reception facilities from untreated sewage from ships[51]. Most reported measures for D5 are direct measures (83 % of reported measures), including investments in the improvement of waste water treatment plants, the issuance of permits for the use of water and action programmes to reduce the outflow of nitrogen from agricultural sources. On the other hand, an EEA Report[52] identified a gap between targets and measures taken to achieve the objectives that prevent reducing nutrient inputs effectively e.g. input from diffuse sources is not adequately addressed by the measures.

Under Article 18 MSs reported an update on the progress of measures. Data from WISE Marine shows most measures have started (approximately 40 %), while the implementation has not started for about 8 %. Only about 5 % of the measures have already been implemented[53].

2.5 How well-established are the monitoring systems in place in Member States with regard to this Descriptor? What mechanisms are in place to monitor progress toward GES? (Article 11 MSFD)

Results from the JRC's assessment on the 2020 Article 11 reporting[54] show 43 % of the reported monitoring programmes were modified from 2014, 29 % were new programmes, and 28 % were the same programme as in 2014. Across all descriptors, D5 had more new programmes and slightly fewer programmes unchanged or modified from 2014. The report found the number of elements reported by Baltic Sea MS were greater than those reported for the other marine regions for all the D5 criteria.

According to the JRC report of 2018 reports[55], there were more than 10 monitoring methods used in the first reporting cycle to assess parameters for D5 at the national level, combining different percentiles, satellite and in situ data and annual or seasonal metrics. A minority of MSs provided additional details on methods followed in monitoring in their Article 18 reporting (for the first cycle). Recommendations from the same JRC report stated that the reporting framework should be organised to encourage and support MSs to report in a homogenised and straightforward way the methodological approaches. In addition, the report found that improved coordination of monitoring and assessment is needed between the WFD and MSFD[56].

2.6 What is the current state of work of the CIS and RSCs in relation to the different components of the marine strategies?

WG ECOSTAT group has the mandate to ensure the information on nutrients is exchanged between those implementing the WFD, the MSFD and RSCs[57]. Specifically, WG ECOSTAT was mandated to deliver a report

[49] Article 16 EU Overview Report.
[50] Article 16 EU Overview Report.
[51] Article 16 EU Overview Report.
[52] Peterlin, M. ed., 2019. *Nutrient Enrichment and Eutrophication in Europe's Seas: Moving Towards a Healthy Marine Environment*. Publications Office of the European Union.
[53] https://water.europa.eu/marine/data-maps-and-tools/msfd-reporting-information-products/msfd-reporting-data-explorer/programmes-of-measures-progress-of-pom
[54] Tornero V., Palma M., Boschetti S.T., Cardoso A.C., Druon J.-N., Kotta M., Louropoulou, E., Magliozzi C., Palialexis A., Piroddi C., Ruiz-Orejón L.F., Vasilakopoulos P., Vighi M., Hanke G., Marine Strategy Framework Directive Review and analysis of EU Member States' 2020 reports on Monitoring Programmes, (MSFD Article 11), EUR 31181 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-55778-4, doi:10.2760/8457, JRC129363.
[55] Dos Santos Fernandes De Araujo, R. and Boschetti, S., 2021, *Marine Strategy Framework Directive Review and analysis of EU Member States' 2018 reports - Descriptor 5: Eutrophicatio*n, EUR 30677 EN, Publications Office of the European Union, Luxembourg.
[56] Peterlin, M. ed., 2019. *Nutrient Enrichment and Eutrophication in Europe's Seas: Moving Towards a Healthy Marine Environment*. Publications Office of the European Union.
[57] Work Programme 2019-2021. Common Implementation Strategy for the Water Framework Directive (2000/60/EC) and the Floods Directive (2007/60/EC).

comparing Biological Quality Elements (BQE) criteria and threshold values used for eutrophication assessment in coastal waters under WFD, MSFD and RSC (2022-2024 work plan). It is noted that WG ECOSTAT and MSFD WG GES coordinate where necessary, including through specific meetings with MSFD CIS groups[58].

OSPAR has a dedicated group, the intersessional Correspondence Group on the MSFD which, includes D5 experts (ICG Eutrophication). The HELCOM Group on the implementation of the ecosystem approach (Gear) deals with the MSFD implementation. Specifically, the Intersessional Network on Eutrophication (IN Eutrophication) deals with D5. Neither the Mediterranean nor the Black seas have specific groups for D5. For these regions, projects and pollution protocols from different sources address eutrophication. For example, in the Mediterranean region, UNEP/MAP has the ECAP coordination group and the CORMONs, which do the necessary work for the QSR 2023, and is fundamental for MSFD implementation at regional level. Additionally, the Programme for the Assessment and Control of Marine Pollution in the Mediterranean (MED POL) deals with different sources of pollutions including land-based sources and wastewater. Under the Barcelona Convention, a new Working Group is being set up to implement the new Regional Plan on UWWT and sewage sludge management.

3 LOOKING FORWARD

3.1 How do climate change and this Descriptor interact?

Climate change is predicted to affect pressures on the marine environment in various ways. Regarding eutrophication, changes in water temperatures might affect water stratification and increase flood events, which may lead to higher nutrient loads into the water and worsen eutrophication. Taking climate change into account (consideration of the effect of climate change on nutrient inputs, and adapting management measures to address climate change effects) may highlight potential environmental targets and measures for nutrient reduction, which in turn would favour setting realistic deadlines[59].

3.2 What are the upcoming policy trends?

The **new CAP** was adopted in 2021 and it will be put into place in January 2023. It supports the EU Green Deal targets by bringing agriculture practices closer to the targets of the Farm to Fork strategy and the Biodiversity Strategy 2030 with regard to reduced nutrient pollution[60]. It is expected that decoupling agricultural subsidies from production will reduce the use of fertilisers on farms. Furthermore, a significant proportion of the CAP's budget will be devoted to eco-schemes, which can support voluntary practices by farmers that contribute to the sustainable use of nutrients[61]. A range of agricultural practices has been suggested to improve on-farm nutrient management[62].

The ongoing revision of the **UWWT Directive** aims to align the Directive with the European Green Deal and the Zero Pollution Action Plan. The evaluation confirmed that implementing the Directive remains crucial to meeting the objectives of the WFD and the MSFD. The evaluation highlighted that some MS implementation is lagging behind, stormwater overflows will increase the pressure on surface water bodies due to climate change and the predicted heavy rainfall events, and that small agglomerations/non-connected dwellings are an important source of pollution to water bodies. Addressing these issues would result in a significant reduction of pollution in the EU's water bodies[63].

3.3 How is progress towards GES expected to evolve within the current MSFD?

[58] Draft Work Program 2022-2024 for Working Group ECOSTAT.
[59] Peterlin, M. ed., 2019. *Nutrient Enrichment and Eutrophication in Europe's Seas: Moving Towards a Healthy Marine Environment*. Publications Office of the European Union.
[60] EC, 2021. List of potential agricultural practices that eco-schemes could support, https://agriculture.ec.europa.eu/system/files/2021-01/factsheet-agri-practices-under-ecoscheme_en_0.pdf.
[61] EC, 2021. List of potential agricultural practices that eco-schemes could support, https://agriculture.ec.europa.eu/system/files/2021-01/factsheet-agri-practices-under-ecoscheme_en_0.pdf.
[62] https://agriculture.ec.europa.eu/sustainability/environmental-sustainability/low-input-farming/nutrients_en
[63] https://ec.europa.eu/environment/water/water-urbanwaste/evaluation/index_en.htm

The 2019 EEA's report[64] states that improvements will continue as the reduction of nutrient inputs is maintained. Recovery patterns are expected in areas that suffer from eutrophication once relevant targets and measures are implemented. However, the WFD objective should be reached by 2027 at the latest and the observed water quality trends show that this will not be achieved[65]. Progress will be made, but there is a risk of not achieving Good Ecological Status for all water bodies by 2027[66]. There will be a need to further improve the status of water bodies after 2027, but it is still unclear what will happen in terms of the WFD beyond the 2027 deadline. Similarly, under the MSFD, progress towards GES is expected, but the achievement of GES is not guaranteed.

3.4 Are there any other developments expected in the next 30 years?

The 2021 staff working document on Digital Solutions [67] outlines the advantages that digital tools bring for striving towards the Zero Pollution ambition in agriculture. Digital technologies such as drones can be used to monitor soil health and plant nutrient needs. Sensors to monitor near real-time data can be used in making decisions on for instance the optimal amount, place and time for use of fertilisers. Satellite data (Copernicus, Galileo) can help with creating sustainable nutrient management plans[68].

In addition, the Commission's proposal for the post-2020 CAP included the use of the Farm Sustainability Tool (FaST) to help improve farm nutrient management[69]. This tool provides advice on the use of fertilisers using a mobile application and a web-based solution and helps comply with legislative requirements related to nutrient management, resulting in less pollution by nutrients. This application has direct access to remote sensing data from Copernicus and Galileo.

Similarly, Tidal[70], based on underwater cameras and sensors, helps fish farmers optimise the food put into the water reducing the pollution by nutrient losses.

[64] Peterlin, M. ed., 2019. *Nutrient Enrichment and Eutrophication in Europe's Seas: Moving Towards a Healthy Marine Environment*. Publications Office of the European Union.
[65] SWD(2021) 1001 final.
[66] Water Director's meeting, 29.11,2018. The future of the Water Framework Directive (WFD) – Water Directors input to the fitness check process on experiences and challenges of WFD's implementation and options for the way forward. Slides available: https://circabc.europa.eu/sd/a/6d96ebfe-a04e-4b2a-b112-b00a8ef47e97/WD2018-2_Session%202_Consultation%20Group.pdf.
[67] SWD(2021) 140 final.
[68] https://ec.europa.eu/eip/agriculture/en/news/inspirational-ideas-digital-tool-building-picture.
[69] https://ec.europa.eu/eip/agriculture/en/focus-groups/digital-tools-sustainable-nutrient-management.
[70] https://blog.x.company/introducing-tidal-1914257962c3.