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Marine Strategy Framework Directive

Review and analysis of EU Member States' 2020 reports on Monitoring Programmes

MSFD Article 11

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Contents

Abstract

According to Article 17(2) of the Marine Strategy Framework Directive (MSFD), Member States (MS) have to review their marine strategies every six years. This includes the report on monitoring programmes under Article 11, which was prepared in 2014, and updated by 2020.

The JRC has reviewed and analysed those MS's reports on monitoring programmes from a scientific, technical point of view with the aim of analysing the level of harmonisation and completeness of monitoring across Europe, identifying potential hindrances and gaps on the reporting procedure, and providing recommendations for further work or guidance to improve MSFD implementation in the next cycle. The outcomes of this analysis also provide a useful basis to support ongoing discussions in the context of the MSFD review process.

The analysis is based on eighteen MS (BE, CY, DE, DK, EE, ES, FI, FR, HR, IE, IT, LT, LV, NL, PL, RO, SE, SI) that have reported by January 2022 (out of the 22 EU MS with a sea border).

Regarding the analysis methodology followed, the e-reports submitted by the MS were extracted as excel files from the WISE Marine portal, the European Environment Agency (EEA) interface used by MS for reporting. A template with a set of questions was developed by the JRC to guide the review and ensure harmonisation in the analysis across descriptors. Those questions were namely focused on the analysis of i) the consistency, adequacy and coherence of reported features, elements and parameters, ii) the consistency and adequacy of collected data, iii) the coherence with other policies, iv) the future monitoring plans, and v) the progress compared to the previous reporting cycle in 2014.

The review has identified a number of reporting issues that somehow can hamper the analysis. Those issues have been compiled with the aim of being considered for improvement and facilitation of the reporting process through the Working Group on Data, Information and Knowledge Exchange (WG DIKE) and the EEA in the next reporting cycle.

The review has showed that about one-third of the monitoring programmes reported by MS remained unchanged from 2014, while the remaining two-thirds are modifications, updates and new programmes, which suggests MS adjustments for MSFD implementation. However, reporting on monitoring programmes is still missing for some descriptors in some MS and the coverage of MSFD criteria is incomplete and not homogenous among MS.

The report compiles the elements, features and parameters reported by MS for all MSFD descriptors, hence providing an overview of what is actually and concretely monitored across EU. This overview represents the basis for the subsequent analyses, including that of the level of harmonisation and coordination of monitoring at regional level. Many current monitoring issues and gaps are likely linked to the lack of agreed approaches or methodological standards for the different criteria/descriptors. Therefore, the work towards the clear identification of gaps and their consideration as priority work items to be addressed within the existing Technical Groups and Expert Networks is crucial to increase harmonization and develop monitoring synergies. This report outlines the main needs for further technical work and monitoring concerning the different descriptors.

The report also analyses the spatiotemporal scope of monitoring. While some insights can be provided on the areas where monitoring is focused (e.g., D8C1 monitoring mostly happens in coastal waters, while offshore monitoring is limited), the reporting does currently not provide enough technical details to understand where and at what frequency which monitoring takes place. Therefore, it is not possible to accurately assess the variability of the sampling strategy. The collection and access to more detailed information, facilitated for instance by the continuous introduction of monitoring programme updates as they happen could be a beneficial way forward.

The reporting under MSFD Article 11 also requires reporting on other MSFD implementation elements. However, it has been seen that with the reported information it is challenging to properly assess the links with other MSFD reporting obligations (namely MSFD Articles 8, 9, 10 and 13). This is probably because there are still gaps in understanding which elements/parameters should be monitored to assess Good Environmental Status, the conceptual approaches to set targets and what should be reported for monitoring related to measures.

The reporting should also inform on which other EU policies and international agreements (including Regional Sea Conventions), the monitoring programme contributes. Overall, there is high variability among MS in relation to the directives and regional monitoring programmes reported. Harmonization is found for those policies that

are already referenced in the GES Decision ((EU) 2017/848)[1], namely the Water Framework Directive (WFD) for D5 and D8, the Foodstuff Regulation for D9, the Common Fisheries Policy (CFP) for D3, and the CFP and Birds and Habitats Directives for D1. There is also some level of harmonization in the reporting of regional monitoring programmes, mostly OSPAR and HELCOM programmes, respectively by Atlantic and Baltic countries.

MS have provided links to the monitoring data for all descriptors, although the number of links vary considerably among MS. However, the direct data access or downloading from those links are typically not available (e.g., most of the links are not connected to a specific dataset, but lead to a generic webpage or a pdf report). Efforts are therefore still needed to improve the findability and accessibility to the original data (and metadata).

A proper evaluation of the progress of monitoring from 2014 and the potential fulfilment of monitoring gaps is not possible because the differences between the 2014 and 2018 reporting systems led to incomparable datasets (e.g., many entries from the 2014 reporting were missing or reported differently in 2018). This is expected to be resolved in the coming reporting cycles.

Finally, it is important to highlight that monitoring environmental parameters for the holistic assessment of the marine environment is an enormous task, as it covers numerous aspects of marine Good Environmental Status, ranging across many, very diverse, marine species and multiple anthropogenic pressures. The efforts made by the EU MS are remarkable and, despite some shortcomings identified in this report, it should be recognized that coordinated environmental marine monitoring in the EU under the MSFD and aligned with four Regional Sea Conventions is a globally unique achievement.

([1]) Commission Decision (EU) 2017/848 of 17 May 2017 laying down criteria and methodological standards on good environmental status of marine waters and specifications and standardised methods for monitoring and assessment, and repealing Decision 2010/477/EU

Foreword

The Marine Directors of the European Union and all EU Member States have jointly developed a common strategy for supporting the implementation of the “Marine Strategy Framework Directive” (MSFD), 2008/56/EC, amended by Commission Directive (EU) 2017/845 of 17 May 2017.

The European Commission Joint Research Centre is delivering thematic technical reports to support the MSFD implementation, such as guidance documents, technical background reports and analyses related to EU Member States reporting. These thematic reports are targeted at experts who are directly or indirectly implementing the MSFD and support the further development of the Directive.

This JRC's technical report “Marine Strategy Framework Directive - Review and analysis of EU Member States' 2020 reports on monitoring programmes”, analyses, from a technical point of view, the MSFD reports submitted by EU Member States pursuant to MSFD Article 17. The analysis includes the monitoring programmes (Article 11). The outcome provides information to facilitate the MSFD implementation.

1 Introduction

According to Article 17(2) of the Marine Strategy Framework Directive (MSFD), Member States (MS) have to update their marine strategies every six years. This includes the report on monitoring programmes under Article 11, which was prepared in 2014, and updated by 2020. Guidance on the contents and formats to be used for the reporting has been developed in the context of the MSFD Common Implementation Strategy[2].

The JRC is reviewing those MS's reports on monitoring programmes from a technical, scientific point of view to analyse harmonisation and completeness, identify potential hindrances and gaps and suggest further work or guidance needed to improve MSFD implementation in the next cycle.

The main goals should be:

- To have an EU overview on what is actually and concretely monitored, at what frequency and where, and provide recommendations for descriptor-specific technical work (including, to the extent possible, a kind of benchmark between MS)
- To analyse, as far as possible, the adequacy of the collected data for assessing the state of the sea, the effects of the measures taken and the attainment of GES
- To provide a summary of regional coherence and key shortcomings (as far as possible and if the information is provided under Art. 11, this summary can include insights on how the MSFD-reported data compare with the data reported to the Regional Sea Conventions (RSC), e.g., if the data/formats are the same, if there is more or less information and if and to which extent synergies/resources' savings occur)
- To analyse the coherence of MS reporting with those under other EU legislation (in particular waste and water framework directives, common fisheries' policy, single use plastics, habitats and birds directives) and if MSFD data support the other Directives' implementation and vice versa
- To highlight particular national shortcomings not already identified at regional level
- When (if) feasible, to provide a comparison with 2014 monitoring programmes, in particular regarding the fulfilment of MS 2014 commitments

The outcomes of the JRC analysis of the MS's monitoring programmes also provides relevant conclusions and recommendations to support the ongoing discussions and processes in the context of the MSFD review (MSFD Article 23).

([2]) European Commission. 2020. Reporting on the 2020 update of Article 11 for the Marine Strategy Framework Directive (MSFD Guidance Document 17). Brussels. Pp 51. https://circabc.europa.eu/rest/download/bc5bb466-2855-4308-be2e-4a585ee8ba69

2 Methodology

A review template with a series of main headers (each linked to a series of sub-headers and questions) was prepared to guide this review, namely focused on the analysis of:

1. Consistency, adequacy and coherence of reported features, elements and parameters: EU and regional overview on what is actually and concretely monitored, at what frequency and where.
2. Consistency and adequacy of collected data: whether the data collected are sufficient and useful to properly assess GES and the effects of the measures.
3. Coherence with other policies: whether monitoring is or is not coherent with other relevant directives.
4. Future monitoring: whether there are gaps in current monitoring with clear plans by when they will be filled.
5. Progress in comparison with the 2014 monitoring programmes.

By January of 2022, eighteen MS had reported electronically (e-reports) for MSFD Art.11 - monitoring programmes: Belgium (BE), Cyprus (CY), Germany (DE), Denmark (DK), Estonia (EE), Spain (ES), Finalnd (FI), France (FR), Croatia (HR), Ireland (IE), Italy (IT), Lithuania (LT), Latvia (LV), the Netherlands (NL), Poland (PL), Romania (RO), Sweden (SE), and Slovenia (SI).

These e-reports, merged by descriptors, were extracted as excel files from the Water Information System for Europe (WISE)-Marine, a portal developed in a partnership between the European Commission and the European Environment Agency (EEA) that shows the information and knowledge gathered or derived through the MSFD process and other key marine policy drivers (https://water.europa.eu/marine/assessment-module/national-descriptors-assessments/reports-per-descriptor).

Data were formatted as tables using the headers of the fields as on WISE national monitoring dashboard to enable the selection by filtering of the information. For the analysis, pivot tables were used to summarise the reported information and address the specific review questions. According to the nature of the data, visualization tools are used to graphically show the results as appropriate. The source for all the figures and tables presented in this report is the JRC analysis of MS'reports for MSFD anrticle 11.

3 Overarching considerations

3.1 Monitoring for the MSFD

Monitoring environmental parameters for the holistic assessment of the marine environment is an enormous task, as it covers numerous aspects of marine Good Environmental Status, ranging across many, very diverse, marine species and multiple anthropogenic pressures. Even more so when it is done across 18 countries and covering marine areas comprising an extension of 30 degrees latitude and more than 60 degrees longitude. Monitoring the marine environment is furthermore a challenge due to the remoteness and relative inaccessibility of the Seas.

The efforts made by EU MS are remarkable and despite shortcomings identified in this report, it should be recognized that coordinated environmental marine monitoring in EU under the MSFD and aligned with four Regional Sea Conventions is a globally unique achievement.

The information on monitoring programmes collected through the MSFD reporting system at the EEA and analysed in this report included 39 different reporting fields for each of the 11 MSFD descriptors (with D1 split into four different species groups and pelagic habitats), which makes a total of approximately 23500 reporting cells. For instance, 357 fish species have been reported as D1 elements and 316 chemical contaminants under D8, to just give a glimpse on the complexity of the reported information.

3.2 Timing

The MSFD is based on 6-year cycles in which assessments, monitoring and measures are reported in a repeated sequence. This implies that the reporting on monitoring programmes under Article 11, which was initially prepared in 2014, was to be updated by 15 July 2020 and notified to the European Commission by 15 October 2020 at the latest. The reporting represents a heavy workload for MS and, although it has been improved and facilitated through guidance and adjustments provided (MSFD Guidance Document 17), it seems clear that MS struggle to report on time. Indeed, by October 2020, complete reporting (e-reports and text reports) was provided by only 4 MS and by the end of 2021, reporting was still missing for 5 MS. Delays in reporting lead to delays in MSFD implementation.

3.3 Reporting issues

As it can be seen in Figure 1, a significant proportion (32%) of the monitoring programmes remains the same as in the 2014 reporting cycle (up to 50% for some descriptors) and the number of new programmes is relatively low (15%). There are, however, a number of modifications or updates (53%) that MS have introduced in their monitoring programmes over time, although, from the Art. 11 reporting, the identification of those modifications is not at all straight forward.

For all descriptors, the MS e-reports include additional entries other than those specifically corresponding to the Descriptor, in particular under the 'GEScriteria', 'Elements' and 'Features' reporting fields. For instance, the D8 file contains entries that refer to elements relevant for other descriptors (e.g., nutrient levels (DIN and DIP), which correspond to D5) The analysis has been done by filtering the information and considering only those items referring to the Descriptor under review, which sometimes can lead to the dropping of a significant number of reporting entries.

There are three MS (DK, ES and SE) that do not differentiate the marine region to which their monitoring refers, but that report on a single category for the two marine regions they belong to (BAL/NEA or MED/NEA). It is also not possible to differentiate the region from other reporting fields like 'Subregion' or 'MarineReportingUnit', since they normally contain mixed information for both regions. Therefore, those 3 MS have not been included in the analysis of regional coherence, unless otherwise specified (e.g., for D9, where the monitoring descriptions allow the differentiation of the regions concerned in those countries). The "mixed" regions have been however included in the figures for the analysis of regional coherence in relation to the different D1 species groups.

Moreover, the way the information is provided under some reporting fields makes it difficult to understand what is actually monitored. For instance, many different parameters, spatial areas or links to data are usually provided in the same reporting cell, separated by a comma without space.

When a drop-down menu is not available (e.g., for D8C2 or D6 parameters), MS can use different names to

refer to the same parameter. This can lead to erroneous messages, including those concerning regional harmonisation.

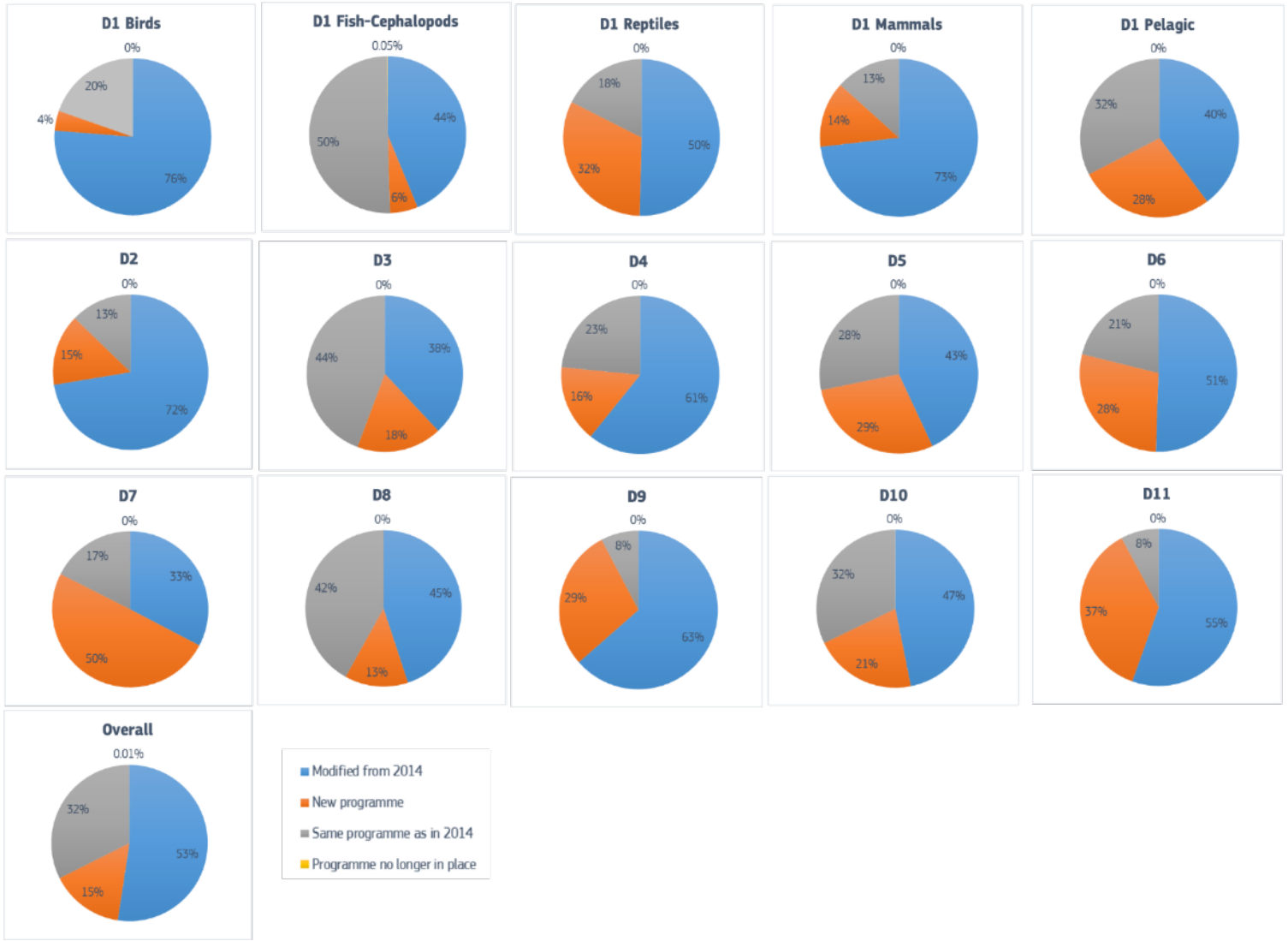


Figure 1. Proportion of reported monitoring 'update types'

4 Consistency, adequacy and coherence

4.1 Consistency, adequacy and coherence of reported features, elements and parameters

This section provides an EU overview on what (features, elements, parameters) is actually and concretely monitored within the different MSFD Descriptors, where (spatial scope) and when (start date, frequency). An analysis of regional coherence regarding the coverage of reported features, elements and parameters is also provided.

4.1.1 Coverage of features, elements and parameters for the descriptor

The MSFD reporting needs to consider reporting for the features (ecosystem components, pressures, activities), elements (e.g. specific species, habitats, contaminants, litter categories) and parameters monitored (e.g., species and tissues used for D8C1 monitoring), as stated in the monitoring reporting guidance (MSFD Guidance Document 17)[3]. The features, parameters and/or elements reported by MS are compiled in Annex I below in order to provide an overview of what is monitored for the different descriptors across Europe. Additionally, a summary of the main findings is provided here.

D2

For D2C1, there is not an official list of elements and, therefore, the 16 MS (BE, DE, DK, EE, ES, FI, FR, HR, IE, LT, LV, NL, PL, RO, SE, SI) reported correctly 'not applicable' (Annex I, Table A1). Species presence ('pre') is the most used parameter for D2C1 monitoring, but also abundance, biomass, distribution, and incidence (Annex I Table A1).

For D2C2, 291 elements (i.e., species, species groups, and habitat types) were reported by 12 MS (CY, DK, EE, ES, FI, FR, IT, LT, PL, RO, SE, SI), using eight different parameters (Annex I Table A2).

Instead of the elements (i.e., D1 and D6 species groups and habitats) listed in the MSFD Reporting Reference List[4], MS have monitored two NIS for D2C3 (Annex I Table A3).

MS have reported on five features: 13 MS (BE, DE, DK, EE, ES, FI, FR, HR, IE, LT, LV, NL, PL, RO, SE, SI) on three features ('PresEnvNISnew', 'PresBioIntroNIS', 'PresBioIntroMicroPath') for the criterion 'Newly introduced non-indigenous species' (D2C1); 13 MS (CY, DK, EE, ES, FI, FR, IT, LT, LV, PL, RO, SE, SI) on two features ('PresEnvNISestablished', 'PresBioIntroNIS') for the criterion 'Established non-indigenous species' (D2C2); and 5 MS (EE, LT, PL, RO, SI) on two features ('PrevEnvAdvEffectsSppHab', 'PresBioIntroNIS') for the criterion 'Adverse effects on marine species or habitats' (D2C3).

D3

When filtering the entries marked as 'D3C1', 'D3C2' and 'D3C3' under the reporting field 'GESCriteria', it was noted that 4 MS (DE, IT, LV, SE) had reported under 'Feature', entries other than 'FishCommercial', which is the only feature relevant to D3 (Annex I Table A4). This issue was more acute for LV and DE where 100% and 87% of the total entries, respectively, were under non-typical feature categories (Table A4).

Breaking down the feature reporting by criterion, 17 out of 18 MS (all but LV) reported the correct feature (i.e., 'FishCommercial') for D3C1, D3C2, while 3 MS (DE, IT, SE) also reported non-typical features for some of their entries under D3C1 and 2 MS (DE, IT) under D3C2. For D3C3, 13 MS reported the correct 'Feature' (i.e. 'FishCommercial'), and 3 MS (DE, IT, LV) also non-typical features.

For the rest of D3 analysis, it was decided to filter the entries under 'Feature' categories 'FishCommercial', 'FishCoastal', 'FishDemersalShelf' and 'FishPelagicShelf', because filtering only the entries under the correct feature category (i.e., 'FishCommercial') would lead to the omission of all entries by LV and of the majority of entries by DE. Entries under feature categories 'ActivExtrLivingFishHarv' and 'PresBioExtractSpp' (reported by LV, IT, SE) were omitted, because they were coupled with 'Not Applicable' (rather than species names) under 'Element'. Notably, this resulted in dropping all entries of LV for D3C2 and D3C3. The filtering of 'D3C1', 'D3C2' and 'D3C3' under 'GESCriteria' reduced the dataset from 4275 to 2308 entries, while the subsequent filtering of 'FishCommercial', 'FishCoastal', 'FishDemersalShelf' and 'FishPelagicShelf' under 'Feature' reduced the

([3]) https://circabc.europa.eu/rest/download/bc5bb466-2855-4308-be2e-4a585ee8ba69
([4]) https://cdr.eionet.europa.eu/help/msfd/Guidance/Reference_List_Art11_v2.11.xlsx

dataset further to 2282 entries.

On 'Elements', 148 unique entries were reported by the 18 MS (Annex I Table A5). All MS except BE reported the scientific names of the monitored organisms, typically at species level and sometimes at genus or family level. Notably, 1 MS (BE) had erroneously reported 'Demersal fish community' instead of providing separate entries for each species, and then provided a pooled list of stocks under 'RelatedIndicators'.

The number of reported elements varied greatly, ranging from 4 (LT, PL) to 90 (DK), with an average of 24 elements (Table A5).

D5

The Parameters used for monitoring elements of D5C1 were CONC-W, OTH, MASS, EMI and DEP (Annex I Table A6). For D5C2, MS reported CONC-W and for D5C3 ABU, BIOM, DUR, OTH, SPP, EXT, FRE, CELL-C, and OTH (Table A6). TUR, TRA, EXT and OTH are the parameters reported for D5C4, whereas CONC-W is the only parameter for the element 'Oxygen Dissolved' (D5C5) (Table A6). D5C6, D5C7 and D5C8 used the parameters ABU, EXT, COV, ABU-REL and OTH for monitoring benthic assemblages of macrophytes, opportunistic macrophytes and macrobenthic communities. Under D5C1, 3 MS (DE, IE, IT) reported 'Not Applicable' under 'Element' with the parameters CONC-W and OTH. 'Not Applicable' was also reported for D5C2 and D5C5 by IT with the parameter CONC-W, and for D5C3 by LT reporting for the EXT parameter (Table A6).

D7

MS have reported 37 different features, 47 elements and 20 parameter categories. However, most MS reported on the most relevant features for the descriptor, being 'PresEnvHydroChanges' (15 MS: BE, CY, DE, DK, EE, ES, FI, FR, HR, IE, IT, LT, NL, SE, SI), 'CharaPhyHydro' (9 MS: DE, EE, ES, FR, IE, LT, LV, PL, SE) and 'CharaChem' (3 MS: DE, ES, LT) for D7C1, and 'HabBenBHT' (9 MS: EE, FR, IE, LV, NL, PL, RO, SE, SI) and 'HabBenOther' (3 MS: FR, LV, SE) for D7C2. Few MS also reported on a number of features based on Activities and/or Pressures that are related at different levels with D7.

Annex I Table A7 and Table A8 compile the elements and parameters reported for D7. For D7C1, MS reported 26 elements, with a high variability in the number (from 2 (BE, CY, EE) to 13 (SE)) and types of elements reported by each MS, with current regime, salinity, temperature and wave regime most consistently reported across MS. For this criterion, MS indicated 10 parameters, of which the most recurrent ones were 'EXT' and 'OTH'. For D7C2, MS reported 24 elements, also with a high variability in the number (from 1 (ES, FI) to 15 (FR)) and types of elements reported by each MS, The most consistently reported elements across MS were those related with some specified circalittoral and infralittoral habitats. 'EXT' and 'OTH' are the only parameters reported for this criterion.

Some MS included also few parameters without specifying the element (indicated as 'Not Applicable'): DK, ES, FI did so for both criteria, while IE and SE only for D7C1. A variety of elements were also reported as 'Not relevant' or a null value under the 'GEScriteria' field.

D8

MS essentially report on the corresponding feature(s) for the different D8 criteria, namely 'PresEnvContUPBTs' (18 MS) and 'PresEnvContNonUPBTs' (17 MS: all but SI), and to a lesser extent 'PresInputCont' (5 MS: DE, EE, FI, IE, LT) in relation to D8C1, 'PresEnvAcuPolluEvents' in relation to D8C3 (9 MS: BE, DK, EE, ES, HR, IE, LV, NL, SI), and 'PrevEnvAdvEffectsSppHab' in relation to D8C2 (11 MS: DE, DK, EE, ES, FR, HR, IE, LV, NL, PL, SE) and D8C4 (4 MS: EE, ES, FR, SE). For D8C1, FI also reports on the features 'ActivTranspShip' and 'ActivProdEnerNonRenew'. For D8C2, BE also reports on 'BirdsPelagicFeeding' and IT on 'PresEnvContNonUPBTs' and 'PresEnvContUPBTs'. For D8C3, FI and SE also report on 'PresInputCont'.

In relation to D8C1, 316 elements (contaminants) have been reported in total: 29 metals/metalloids, 222 organic pollutants, 62 radionuclides, and 3 "general" elements ('all contaminants', 'WFD non UPBT substances', and 'WFD UPBT substances'). However, there is a high variability in their consideration by MS. For instance, SE reports up to 195 contaminants, while CY and LV only report on 7 and 19 contaminants, respectively. Moreover, IT and SI do not specify the substances monitored and only report on one element 'all contaminants'.

Priority Substances (PS) of the Water Framework Directive (WFD)[5] are the contaminants most frequently reported, especially cadmium, mercury, lead, nickel, PAHs, PBDEs, PFOs, HCB, dioxins and dioxin-like PCBs, nonylphenols and TBT compounds. Contaminants other than WFD PS are sparsely reported. Metals like copper (14 MS: BE, DE, DK, EE, FI, FR, HR, IE, LT, LV, NL, PL, RO, SE), zinc (13 MS: BE, DE, DK, EE, FI, FR, HR, IE, LT, LV,

([5]) https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32013L0039

NL, PL, SE) and chromium (12 MS: DE, DK, EE, FI, FR, HR, IE, LT, NL, PL, RO, SE) are the most frequently monitored additional contaminants.

It is relevant to highlight that many radionuclides are monitored, although, with the exception of Cs-137 that is reported by 6 MS (DE, EE, FI, LV, PL, SE), most of them are considered by maximum 1 or 2 MS (in particular, SE and BE). Moreover, as a good practice, PL monitors Mustard Gas (Sulfur Mustard/Yperite), which was identified as a potential pollutant entering the marine environment from sea-dumped warfare (Tornero and Hanke, 2016)[6].

Elements for D8C1 have been also reported as 'Not Applicable' by DE (referring to the emission of contaminants from land-based sources and mobile sources as well as atmospheric deposition of metals and PAHs in the Atlantic and the metal inputs from land-based sources in the Baltic), EE (referring to the load of contaminants from rivers in coastal waters), FI (referring to the total oil concentration in water and the discharge of Cs-137, Sr-90 and Co-60 from nuclear power plants and rivers), IE (referring to the atmospheric deposition and freshwater inputs of metals and PAHs), and LT (referring to the monitoring of several pollutants in water in the Baltic Sea).

The parameters (matrix) used for D8C1 are also very variable and depending on the contaminant assessed (Annex I Table A9). For WFD PS (and River Basin Specific Pollutants, RBSP), water is the most common matrix. However, there are countries (CY, DK, ES, FR, IT, LV, and SE) that do not use water as matrix for the monitoring of any metal or organic pollutant. Indeed, concentrations in biota are very often monitored for a number of pollutants, in particular for cadmium (14 MS), lead (13 MS), mercury (15 MS), zinc (11 MS) and PAHs (10 MS). Regarding concentrations in sediments, this parameter is frequently used for substances such as cadmium (15 MS), lead (14 MS), mercury (14 MS), TBT (13 MS), and benzo(a)pyrene (12 MS). It is important to highlight that GES for many combinations of elements/parameters cannot be determined due to the lack of agreed thresholds (there are WFD EQS for the 45 PS in water and for 11 PS in biota, but no legally-binding EQS are set for sediments under the WFD. Likewise, there are no agreed assessment criteria at regional level for all the monitored contaminants in biota and/or sediments).

In relation to D8C2, the methods for the monitoring of biological effects of contaminants are mostly provided under the field 'parameters other', In total, 15 biological-effect methods have been reported (HR and IT report 'ext' or 'other' as parameters, but did not specify the methods used). ES is the MS that monitors a higher number of methods (5 methods). With the exception of imposex (reported by 7 MS: DE, DK, ES, FR, IE, NL, SE), the other methods are often used by only 1 or 2 MS (Annex I, Table A10).

The names used to describe the methods vary among MS and sometimes it is difficult to understand from the reported information when they refer to a particular method or not (e.g., malformed embryos is mentioned by DK, while FI indicates reproductive disorders). It is, therefore, recommended to provide a drop-down menu for reporting this criterion in order to improve the harmonisation of the terminology (similar to that of contaminants under D8C1). Moreover, sometimes several methods (up to four different methods) are reported in the same reporting cell. It would be also advisable to report each method in a different reporting cell in order to facilitate the analysis of comparability among MS.

Most MS reporting on D8C2 (13 MS: BE, DE, DK, EE, ES, FI, FR, HR, IE, LV, NL, PL, SE) report the species monitored as D8C2 elements, while IT includes 'all contaminants' as an element for this criterion. Sometimes, it can be inferred that not all monitored species have been indicated under elements, since the description of the monitoring programmes refers to additional groups of animals (e.g., DK mentions molluscs and crustaceans in relation to D8C2, but no species of these animals are reported under D8C2 elements). Likewise, not all the methods used are reported under D8C2 parameters. For instance, FI reports 'lysosomal activity,' but the corresponding GES criteria is reported as 'Not relevant' (instead of D8C2). Improving reporting in this regard is also recommended in order to facilitate the analysis of the information.

Elements do not need to be provided for D8C3. The relevant parameters monitored for this criterion are 'duration' (BE, DK, FI, HR, LV, SE, SI), 'extent' (BE, DK, EE, ES, FI, IE, SE, SI), and 'incidence' (NL). Other parameters reported include 'amount in surface water and presence' (EE), 'volume, if possible' (ES), 'spatial distribution' (LV), and 'volume chemical fingerprinting' (SE).

For D8C4, elements are not applicable, since the species or habitats affected by acute pollution events cannot be predefined (although FR reports the species *Uria aalgae* as element for D8C4). After the implementation of the monitoring programmes, those elements (species and habitats) can be specified under the next Article 8

(6) Tornero, V., Hanke, G. 2016. Chemical contaminants entering the marine environment from sea-based sources: a review with a focus on European seas. Marine Pollution Bulletin 112, 17-38

report. Only 4 MS have reported parameters for this criterion: 'incidence of adverse effects' (ES, FR), 'abundance (number of dead individuals, ind/km)' (EE), and 'concentrations of hazardous substances in Mytilus' (SE).

D9

MS essentially report on the corresponding feature for D9, namely 'PresEnvContSeafood' (17 MS). DK also reports on 'PresInputCont'. DE does not provide any monitoring programme for this descriptor.

The elements monitored for D9 are compiled in Annex I Table A11. In total, 20 elements have been reported by MS, which mostly correspond to the contaminants of Foodstuffs Regulation 1881/2006[7], as stated in the GES Decision. Nevertheless, one of those contaminants (sum of benzo(a)pyrene, benz(a)anthracene, benzo(b)fluoranthene and chrysene) is reported by 1 MS (BE), while 6 MS (CY, DK, FR, HR, IE, NL) report on the sum of different PAHS (benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene).

FI, NL and PL also monitor few additional contaminants (like TBT, PFOS or arsenic), while FR considers under D9 monitoring the contamination of shellfish by phycotoxins and the microbiological contamination in biota and the water column.

Sometimes, the contaminants are not specified. For example, DK reports some elements as 'Not Applicable', while IT only reports on one element 'all contaminants'.

Table A11 also compiles the parameters reported by MS, which vary among MS. Some MS (BE, EE, ES, FR, HR, IE, NL) only indicate the matrix (biota-total, liver or muscle), other (CY, FI, LV, PL, RO, SE) specify the species monitored, and other MS only indicate fish (LT) or 'other' (DK, SI). For instance, DK provides a link to a Danish webpage under the 'parameter' reporting field. Moreover, FI reports some species, but indicates in their monitoring description that other species (not specified) are also monitored every six years.

There are good practices, as e.g., SE, which explains that ongoing food control monitoring is focused on dioxins and PCBs since these are the substances that pose a risk for human health according to the Swedish Food Agency's risk assessment. Moreover, their ongoing monitoring of contaminants in biota under D8 also provides a basis for foodstuff monitoring of other substances and in other areas.

Additionally, EE and PL also indicate that their D8C1 monitoring programme includes also commercially exploited seafood species. In EE, food safety monitoring is no longer a part of the programme and a new separate programme was created (Contaminant level - in seafood).

D10

MS reported the following features for the D10 criteria: Litter in the environment 'PresEnvLitter' (all the 18 MS) for D10C1, microlitter in the environment 'PresEnvLitterMicro' (15 MS: all but BE, IE, RO) for D10C2, litter and microlitter in species 'PresEnvLitterSpp' (8 MS: CY, DE, DK, ES, FR, HR, IT, NL) and the adverse effects on species or habitats 'PresEnvAdvEffectsSpp' (1 MS: DE) for D10C3 and D10C4, respectively. To a lesser extent, some MS reported other features: Waste treatment and disposal 'ActivUrbIndWaste' (FI) for D10C1, 'PresEnvLitter' (BE) and the input of litter 'PresInputLitter' (SI) for D10C3, and 'PresInputLitter' (EE, SI) and 'PresEnvLitter' (FR) for D10C4.

The elements (litter categories) and parameters (environmental compartment) considered in the monitoring of litter (D10C1) and microlitter (D10C2) have been reported by all the 18 MS and 15 MS (all but BE, IE, RO), respectively (Annex I Table A12 and Table A13). 19 elements (litter categories) have been considered in relation to D10C1, of which ten correspond to the categories defined under the GES Decision and are the most frequently reported. Additional elements frequently considered by MS introduce litter categories in relation to medical and sanitary waste, although they are too general and do not specify the type of litter monitored. For instance, BE, EE, LV and RO only report elements in the category 'Macrolitter (all)' and/or 'Litter in the environment'. For D10C2, the element 'Artificial Polymer Materials' was largely reported by MS, and 4 MS (FI, IT, SE, SI) also considered other materials in addition to microlitter artificial polymers.

The parameters reported in relation to the primary criteria, D10C1 and D10C2, mainly cover the environmental compartments that MS shall monitor according to the GES Decision. Namely litter in the coastline for D10C1 and the microlitter on the surface layer of the water column and in the seabed sediment for D10C2. In addition, ES also reported monitoring programmes for litter in the water column. Some MS reported the environmental compartment under the parameter 'OTH' and provided some additional information in the field 'parameters other' (e.g., 'amount on seabed' – IE, SI; 'Trend in the water' – FR). However, as some of the additional

([7]) https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32006R1881

information is already included in the available drop-down menu for 'parameters', it would be needed to align the terminology in order to improve harmonisation in these cases.

Regarding secondary criteria, MS reported the litter categories 'Artificial Polymer materials' (DE, DK, ES, FR, HR, IT, NL), 'Other materials' (DE, DK, ES, IT), and two additional elements 'Macrolitter (all)' (BE, CY) and 'Not Applicable' (SI) in relation to D10C3 (Table A14). Parameters reported include the amount of ingested litter in biota and the mass of litter ingested. However, the group of animal species monitored is not clearly reflected in any field except for some MS (e.g., *Careta caretta* is indicated by CY) that include it along with the rest of the description of the entire monitoring programme (i.e., including information in relation to other criteria). In this sense, a drop-down menu with the group of animals listed in the GES. Decision could help improve the harmonisation of the reporting.

For D10C4, elements are not applicable since the species or habitats affected by marine litter are not predefined, although DE reported the species *Morus bassanus* and *Uria aalge* as elements. Only 4 MS have reported parameters for this criterion: 'mortality' (DE), 'amount in biota' (FR) and 'other' (EE, SI). The last two parameters do not seem to be entirely relevant for D10C4 without information on adverse effects on the monitored species.

D11

MS have reported in total 33 features, 3 elements and 40 different parameter categories. However, most MS reported on the features 'PresEnvSoundImpulsive' (15 MS: BE, DE, DK, ES, FI, FR, HR, IE, IT, LT, LV, NL, PL, RO, SI) and 'PresEnvSoundContinuous' (14 MS: BE, DE, DK, ES, FI, FR, HR, IT, LT, LV, NL, PL, RO, SE), which are strictly related to D11C1 and D11C2, as well as on the feature 'PresInputSound' (6 MS: CY, DK, EE, LV, SI, SE), which is more generically related to D11 and was listed by 5 MS under D11C1 and by 4 under D11C2. A few MS also reported on features based on activities that are directly related with D11, namely 'ActivMilitary' and 'ActivResearch' under D11C1 (SE), and 'ActivTranspShip' under D11C2 (SE).

For D11C1, elements do not need to be provided. The parameters indicated by MS for the features listed within this criterion included DUR, LEV-N, and OTH (other parameters specified included the number of bang days, spatial distribution, and pulse-block days) (Annex I Table A15).

On the other hand, 10 MS (DE, DK, ES, FI, FR, HR, IT, NL, PL, SE) indicated at least one of the three relevant elements under D11C2, namely Continuous sound, with the 1/3 octave frequency band centered either on 2000 Hz, 125 Hz, or on 63 Hz. The parameters indicated by MS for the features listed under D11C2 included SPL and OTH (including time range, duration, spatial distribution and ship movements).

Finally, 4 MS (EE, ES, FR and SE) reported on a wide number of Activity- and/or Pressure-related features and relative parameters that are not directly related to the criteria of D11, but instead are listed as 'not relevant' or with a null value under the 'GES criteria' field (Annex I Table A16).

D1-Marine Mammals

34 marine mammal species (elements) were reported by 17 MS (all but LT). LT did not report species, with the justification that systematic continuous monitoring of marine mammals (seals, harbour porpoise) is not carried out in the Lithuanian maritime territory, as there are no permanent seal nesting sites, and harbour porpoise is rare in Lithuanian marine waters. However, occurrence data for marine mammals are fragmentarily collected from ongoing projects.

The 34 species were assigned to the four group as shown in Table 1. Annex I Table A17 compiles the species reported per MS for each group.

Table 1. Number of marine mammal's species assigned to each groups according to the GES Decision.

Features cetaceans	**Number of species**
Baleen Whales	7
Deep Diving toothed	11
Small toothed	12
Seals	4

Compared to the previous reporting under Art. 8, 9 and 10 (2018) (Palialexis and Boschetti, 2021)[8], all marine mammals that were assessed have been reported as having monitoring programmes in place.

Regarding the parameters, 16 unique parameters were reported for the five criteria and the 34 species (Table 2).

Table 2. Parameters reported for the D1 criteria for mammals.

Criterion	Parameter	Reporting Code
D1C1	Mortality (weight/volume; number of individuals)	MOR
	Mortality rate	F
D1C2	Abundance (number of individuals)	ABU
D1C3	Sex distribution	SEX-D
	Age distribution	AGE-D
	Breeding success	BREED
	Fecundity (breeding rate)	FEC
	Survival rate	SUR
	Length	LEN
D1C4	Presence	PRE
	Distribution (pattern)	DIST-P
	Distribution (spatial)	DIST-S
	Distribution (range)	DIST-R
	Extent	EXT
D1C5	Coverage (e.g., of a species within a habitat or area)	COV
	Physical structure of habitat (e.g., sediment characteristics, topographic structure)	HAB-STRUCT

D1-Marine Reptiles

One feature (species group) was reported for reptiles by 6 MS (CY, ES, IE, HR, FR, IT). Six elements (species) were reported by 6 MS (CY, ES, IE, HR, FR, IT). The turtle species reported by MS are shown in Table 3.

Table 3. Number of MS reporting on each reptile species.

Turtles	Total: 6
Caretta	4 MS (CY, ES, HR, IT)
Chelonia mydas	2 MS (CY, ES)
Dermochelys coriacea	3 MS (FR, ES, IE)
Eretmochelys imbricata	1 MS (ES)
Lepidochelys kempii	1 MS (ES)
Lepidochelys olivacea	1 MS (ES)

Regarding the parameters, 13 unique parameters were reported for the five criteria for the six species (Table 4).

Table 4. Parameters reported for the D1 criteria for marine reptiles.

Criterion	Parameter	Reporting Code
D1C1	Mortality rate	F
D1C2	Abundance (number of individuals)	ABU
D1C3	Abundance (number of individuals)	ABU
	Breeding success	BREED
	Length	LEN
	Survival rate	SUR
	Sex distribution	SEX-D
	Age distribution	AGE-D
	Fecundity (breeding rate)	FEC
	Other	OTH
D1C4	Distribution (pattern)	DIST-P
	Distribution (range)	DIST-R

([8]) Palialexis, A., Boschetti, S.T. 2021. Review and analysis of Member States' 2018 reports Descriptor 1: Species biological diversity, EUR 30664 EN, Publications Office of the European Union, Luxembourg, ISBN 978-92-79-34256-4, doi:10.2760/27700, JRC124085

Criterion	Parameter	Reporting Code
	Distribution (spatial)	DIST-S
	Coverage (e.g. of a species within a habitat or area)	COV
	Other	OTH
D1C5	Extent	EXT

The comparison between a well-studied species (*Caretta*, reported by 4 MS: CY, HR, ES, IT) and a less-well studied one (*Lepidochelys olivacea*, reported by 1 MS: ES) provides an example of the differences in the capacity of the monitoring programmes to generate parameters and data for the GES criteria (Table 5).

Table 5. Comparison of parameters used for two turtle species.

Parameters reported for *Caretta*	Parameters reported for *Lepidochelys olivacea*
ABU	
BREED	
SEX-D	SEX-D
SUR	SUR
AGE-D	AGE-D
DIST-P	
FEC	
ABU	
DIST-S	
EXT	
F	
LEN	LEN
COV	

D1-Fish and Cephalopods

Six species groups for fish were reported by all the 18 MS. 5 MS reported monitoring programmes for the two cephalopod groups (CY, DE, ES, FR, SI).

The MS reported monitoring programmes associated to 320 unique species (elements). Annex I Table A18 (fish) and Table A19 (cephalopods) show the reported species per MS. These species were assigned to the five features for the fish and two for the cephalopods (Table 6).

Table 6. Number of fish and cephalopod's species assigned to the species groups according to the GES Decision.

Features	Group	Number of species
CephaCoastShelf	Cephalopods coastal/shelf	14
CephaDeepSea	Cephalopods deep-sea	7
FishCoastal	Fish coastal	155
FishDeepSea	Fish deep-sea	15
FishDemersalShelf	Fish demersal shelf	168
FishPelagicShelf	Fish pelagic shelf	34

Regarding the parameters, 20 unique parameters were reported for the five criteria for the fish and two for the cephalopods for the 320 species (Table 7).

Table 7. Parameters reported for the D1 criteria for fish and cephalopods.

Criterion	Parameter	Reporting code
D1C1	Mortality	MOR
	Mortality rate	F
D1C2	Abundance number of individuals	ABU
	Biomass	BIOM
	Sex distribution	SEX-D
	Species distribution	SPP-C
D1C3	Size distribution	SIZE-D
	Age distribution	AGE-D
	Breeding success	BREED
	Fecundity	FEC

	Length	LEN
	Survival rate	SUR
	Distribution (pattern)	DIST-P
	Amount on seabed	AMO-SB
D1C4	Presence	PRE
	Distribution (spatial)	DIST-S
	Distribution (range)	DIST-R
	Coverage (e.g. of species within habitat or area)	COV
	Physical structure of habitat (e.g. sediment characteristics, topographic structure)	
D1C5	Extent	EXT

The comparison of the parameters reported for the well-studied species *Clupea harengus* (reported by 5 MS: DE, DK, EE, FR, SE) and *Dicentrarchus labrax* (reported by 5 MS: DE, DK, ES, NL, SE) versus the less reported species *Chelidonichthys obscurus* and *Bodianus scrofa* (both reported by 1 MS: ES) is shown in Table 8. This reveals the inconsistent way of reporting parameters across those species, which needs to be more harmonised, as well as implementation issues, where an agreed set of parameters needs to be assessed and properly aggregated to the criterion level, and then integrated at species level.

Table 8. Comparison of parameters used for fish species.

Parameters reported for *Clupea harengus*	**Parameters reported for *Dicentrachus labrax***
ABU, BIOM, LEN	AGE-D, SEX-D, SIZE-D, SPP-C
AGE-D, SEX-D, SIZE-D, SPP-C	DIST-P, DIST-R, DIST-S
DIST-P, DIST-R, DIST-S	OTH
OTH	ABU, BIOM, LEN, SAL, TEM
ABU, BIOM	ABU
DIST-P, DIST-R, DIST-S	DIST-P, DIST-R, DIST-S
LEN	LEN
MOR	ABU, OTH
ABU, OTH	AGE-D, LEN, SEX-D
AGE-D, LEN, SEX-D	ABU, BIOM
SIZE-D	ABU, BIOM, OTH
ABU, BIOM	
AGE-D, LEN, OTH, SEX-D	
DIST-R	
vs.	
Parameters reported for *Chelidonichthys obscurus*	**Parameters reported for *Bodianus scrofa***
ABU, BIOM	ABU, BIOM
DIST-R, DIST-S, SIZE-D	DIST-R,DIST-S,SIZE-D

D1-Seabirds

The features for the seabirds are the five species groups (Grazing, Wading, Surface-feeding, Pelagic-feeding birds, and Benthic-feeding birds).

140 species (elements) were reported by 16 MS (CY, DE, DK, EE, ES, FI, FR, HR, IE, IT, LT, LV, NL, PL, SE, SI). RO reported no species and BE only species groups (Annex I Table A20,). The number of bird's species allocated to the species groups are listed in Table 9.

Table 9. Number of bird's species assigned to the species groups according to the GES Decision.

Features	**Nº of species**
Birds Benthic Feeding	17
Birds Grazing	27
Birds Pelagic Feeding	34
Birds Surface Feeding	50
Birds Wading	43

Regarding the parameters, 15 unique parameters were reported for the five criteria for the 140 bird species (Table 10).

Table 10. Parameters reported for the D1 criteria for seabirds.

Criterion	**Parameter**	**Reporting code**

D1C1	Mortality	MOR
	Mortality rate	F
D1C2	Abundance number of individuals	ABU
	Biomass	BIOM
	Sex distribution	SEX-D
D1C3	Size distribution	SIZE-D
	Age distribution	AGE-D
	Breeding success	BREED
	Fecundity	FEC
	Survival rate	SUR
	Distribution (pattern)	DIST-P
D1C4	Distribution (spatial)	DIST-S
	Distribution (range)	DIST-R
D1C5	Extent	EXT

The parameters were neither equally reported for all species nor from all MS. For instance, the well-studied species *Melanita nigra* (reported by 10 MS: DE, DK, EE, ES, IE, IT, LT, NL, PL, SE) has monitoring programmes to generate data for at least seven parameters (ABU, MOR, DIST-P, DIST-R, DIST-S, AGE-D, SEX-D) and *Larus canus* (reported by 10 MS: DE, DK, EE, FI, FR, IE, LV, NL, PL, SE) for at least 10 parameters (BREED, ABU, DIST-P, DIST-R, DIST-S, F, MOR, AGE-D, EXT, FEC). Conversely, the not so well studied *Calderas ferruginea* (reported by 2 MS: EE, IE) has only three parameters reported.

D1-Pelagic Habitats

Fifteen MS reported on D1C6 (BE, DE, EE, ES, FI, FR, HR, IT, LT, LV, NL, PL, RO, SE, SI). CY did not report under the relevant 'GESCriteria' or BPHs 'Features' or 'Elements' fields. 11 MS (BE, DE, EE, ES, FI, FR, LT, LV, RO, SE, SI) reported on 'HabPelBHT' and 6 MS (EE, HR, IT, NL, PL, SE) on 'HabPelOTH' corresponding features. Therefore, HR, IT, NL, PL reported exclusively on 'HabPelOTH'. DE indicated the element 'Diatoms & Dinoflagellates' for 'HabPelBHT', but this is not included in the list of the agreed elements[9].

As seen in Annex I Table A21, there are eight monitoring parameters: EXT was reported by 5 MS (EE, ES, IT, PL, SE), ABU by 2 MS (DE, PL), and ABU-REL by DE. FR, NL and PL reported BIOM, whereas IT and ES reported PP. SIZE-D and SPP-C were reported for 2 (ES, IT) and 3 MS (DE, NL, PL), respectively.

The parameter 'OTH' was reported by 10 MS (BE, EE, FI, HR, IT, LT, LV, RO, SE, SI). Often, these MS reported under the field 'ParameterOther' parameters already available and coded in the MSFD Guidance[9] or did not provide clear descriptions of the used parameters (ES, SI). For example, the parameters CELL-C, CONC-W, TRA, TURB, OXY, TID, VEL, SAL, WAV, CO2, and TEM were misreported within the field 'ParameterOther'. In Table A21 all the parameters reported as 'ParameterOther' were checked and translated to codes accordingly with the table "Parameters_EnumCODE" to provide a correct view of the MS monitoring.

D4

MS reported on the corresponding feature(s) for the different D4 criteria, namely 'EcosysCoastal' (9 MS: DK, EE, ES, FI, HR, IT, LT, SE, SI) and 'EcosysShelf' (8 MS: DK, ES, FI, HR, IT, NL, PL, SE) and to a lesser extent 'EcosysOceanic' (2 MS: ES, IT), 'CharaPhyHydro' and 'PresBioDisturbSpp' (FI). D4C1 and D4C2 were the criteria mostly covered by these features.

Annex I (Table A22 to Table A25) compiles the elements and parameters reported. 11 elements (trophic guilds, TGs) were reported in relation to D4C1 and D4C2, while 10 elements for D4C3 and D4C4.

In all the criteria, high variability is observed among MS. For instance, regarding D4C1, SE reports 8 TGs while DK and EE report 7 TGs, FI 6 TGs, while the other countries between 1 and 3. Only one parameter 'other' is used for D4C1. As for D4C2, SE reports 9 TGs, followed by DK, EE, ES (7 TGs), FI (6 TGs), HR and IT (3 TGs) and LT, SI (1 TG). Abundance and biomass are the main parameters considered, but in some cases for EE, ES, SE and SI, also 'other' is reported as parameter.

D4C3 has the following TGs per MS: ES (7 TGs), DK (6 TGs), SE (4 TGs), FI (3 TGs), LT and NL (2 TGs each), HR, PL, SI (1 TG each). DK, FI, HR, LT, NL, PL report only the 'size-d' parameter, ES and SI only 'other', while SE considers either 'size-d' or 'other' or the combination of both.

D4C4 has the following TGs per MS: DK (7 TGs), ES (7 Gs), FI, HR, SE (2 TGs each) and EE (1 TG). Three

(9) https://cdr.eionet.europa.eu/help/msfd/Guidance/Reference_List_Art11_v2.11.xlsx

parameters reported are 'production', 'pp' and 'other'. In particular, DK reports both 'production' and 'pp' for all the TGs considered, ES and EE report only 'other', FI and HR only 'production', while SE considers 'production' and 'other' for apex predator TG and 'production and pp' for primary producers TG.

D6

All MS have reported elements for D6 (Annex I Table A26).

4.1.1.1 Coherence in the coverage of features, elements, and parameters across MS in the marine region

D2

Figure 2 shows the number of elements monitored by MS in each marine region. A high variability in the number of elements exists for D2C2, for which ES targeted the greatest number (233), followed by DK (44), SE (28) and CY (25). The remaining MS monitored less than 10 elements each.

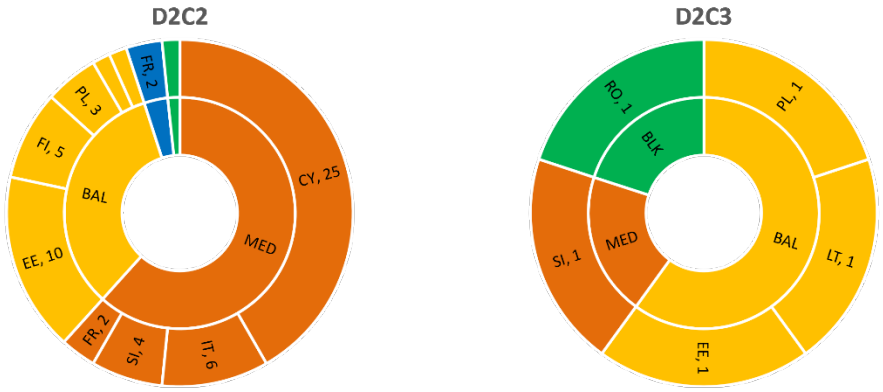


Figure 2. Number of D2 elements reported by MS per region and criterion (ES, DK and SE not included as they reported grouped regions). The figure does not include D2C1, as the elements are 'not applicable' for the criterion. For, D2C3, EE, PL and SI reported 'not applicable' elements, while RO and LT reported one species each.

D3

The regional analysis showed that 4 MS (IT, ES, DK and SE) reported for all their MSFD subregions grouped together. Therefore, ES reporting 29 elements for the combined regions 'MED/NEA' and DK and SE reporting 90 and 41 elements, respectively, from the combined regions 'BAL/NEA' were not included in the regional analysis (Figure 3). IT was included because its grouped subregions (MWE, MIC, MAD) all fell within 'MED'. MS with multiple MSFD subregions should report the elements for each of their MSFD subregions separately, as done by DE and FR.

10 MS (SI, HR, FR, FI, DE, EE, LV, PL, LT, RO) reported less than ten elements by subregion (mostly in BAL and BLK), while 7 MS (IE, NL, FR, IT for individual subregions and DK, SE, ES for combined subregions) reported more than twenty elements (Table A5, Figure 3). While it is expected for different marine regions to exhibit a different number of commercial species, owing to their different species richness (e.g., BAL has a lower biodiversity than NEA), some outlier values of reported elements seem to be due to reporting issues. For example, HR and FR reported a lower than expected number of elements in the MED (Figure 3), implying that some commercial species may have been left out. By contrast, DK and IE, having reported the highest number of elements (Table A5, Figure 3), may imply that some non-commercial species have been also included. Indeed, Table A5 suggests that DK reports on some species that are not commercial (e.g., *Crystallogobius linearis*) or whose fishing is prohibited (e.g., *Alopias spp.*); such species should be reported under D1.

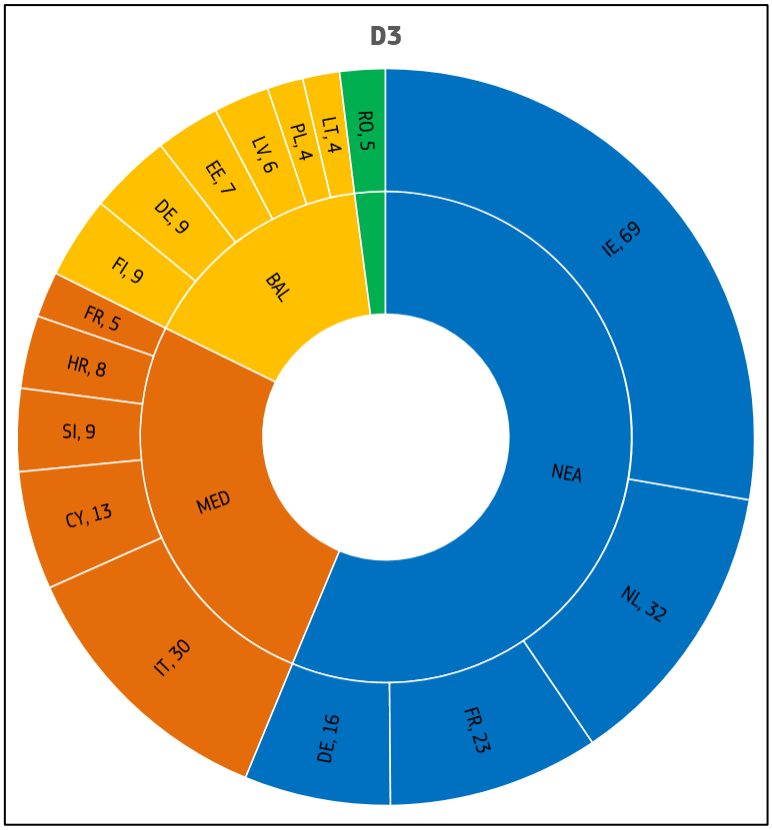


Figure 3. Number of individual elements reported by MS for at least one of the three D3 criteria per marine region (ES, DK and SE not included as they reported grouped regions; BE not included as it did not report individual elements).

Under 'Parameters', there were seven different categories reported by criterion. However, the number of possible quantifications for D3 criteria as envisaged by the GES Decision is quite limited, especially for D3C1 and D3C2. Therefore, the reported categories could be organised into a lesser number of categories (e.g., for D3C1, 'F', 'F,MOR' and 'F,OTH' seem to have been used interchangeably).

For D3, MS should report individual species under 'Elements' (unlike BE). They should also report under the correct 'Feature' category (i.e., 'FishCommercial') (unlike DE, IT, LV, SE). MS should also avoid reporting for combined subregions (unlike IT, ES, DK, SE). Drop-down menus for 'GESCriteria', 'Features', 'SubRegions' and 'Parameters' would be recommended to resolve the issues and improve harmonisation. Moreover, regionally agreed lists of commercial species could be also added as drop-down menus under 'Element'.

D5

The number of elements reported by MS for the Baltic Sea region were greater than those reported for the other marine regions for all the D5 criteria.

For D5C1, SE is the MS reporting the greatest number of elements (11), and RO, IT, FR, BE the lowest (2). D5C2 was reported by all 18 MS with the element 'Chlorophyll-a'.

D5C3 was reported by 9 MS (DE, EE, ES, FI, HR, LV, RO, SE, SI), of which 5 in the BAL. DE reported 4 elements in the NEA and 1 element in the BAL (Figure 4).

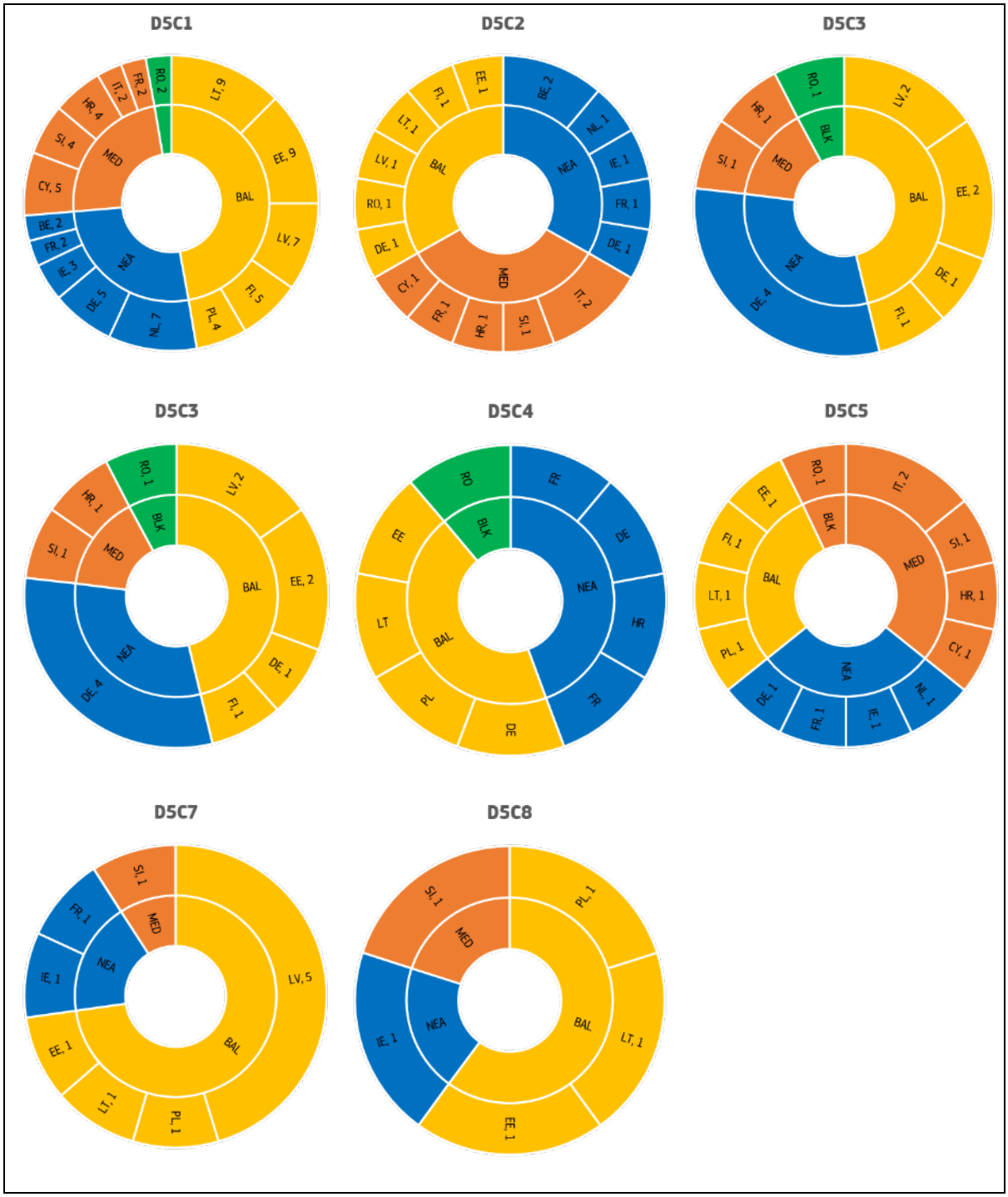


Figure 4. Number of elements reported by MS per region and criterion (ES, DK and SE not included as they reported grouped regions).

D7

Figure 5, Figure 6 and Figure 7 show the number of features, elements and parameters reported by MS across the marine regions for D7C1 and D7C2.

The only feature reported consistently among MS in the marine regions is 'PresEnvHydroChanges', indicated by 6, 6, and 8 MS in the BAL (DE, DK, EE, FI, LT, SE), MED (CY, ES, FR, HR, IT, SI) and NEA (BE, DE, DK, ES, FR, IE, NL, SE) regions, respectively. The other features are only reported by a few MS within each marine region, especially for D7C2. Activity- and Pressure-related features are also variable across regions, with 'ActivProdEnerRenew', 'ActivRestrucCoastDefence', 'ActivRestrucOffshStruc' and 'ActivExtrNonLivingOilGas' indicated by 3 (DK, IE, SE), 4 (DK, ES, IE, SE), 2 (DK, ES) and 2 (DK, IE) MS, respectively, in the BAL and NEA regions, and most other features

indicated in a scattered way by MS (Figure 5). DK, ES, and SE, which are not included in the figure, reported respectively 7, 6, and 3 features for D7C1, and 7, 3, and 2 features for D7C2.

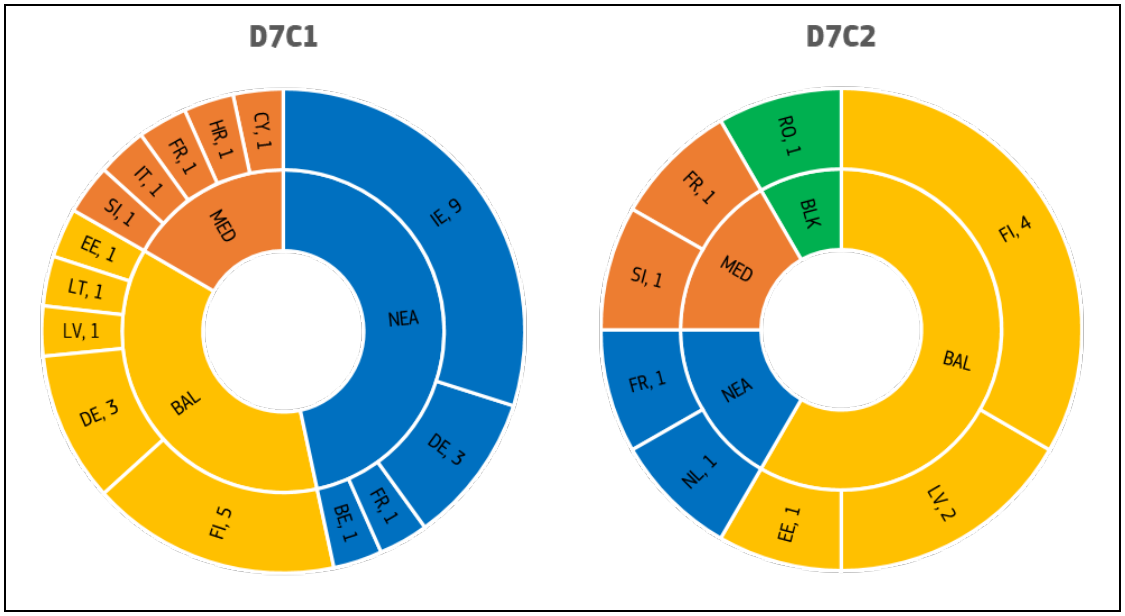


Figure 5. Number of features reported by MS per marine region and criterion (ES, DK and SE not included as they reported grouped regions).

Similarly, the elements reported by MS were highly variable, with only a limited number of elements reported by most MS within each region (Figure 6). Current regime, temperature, salinity and wave regime were the only elements indicated by most MS in the BAL, NEA and MED regions. DK, ES, and SE, which are not included in the figure, reported respectively 0, 8 and 12 elements for D7C1, and 0, 0, and 6 elements for D7C2.

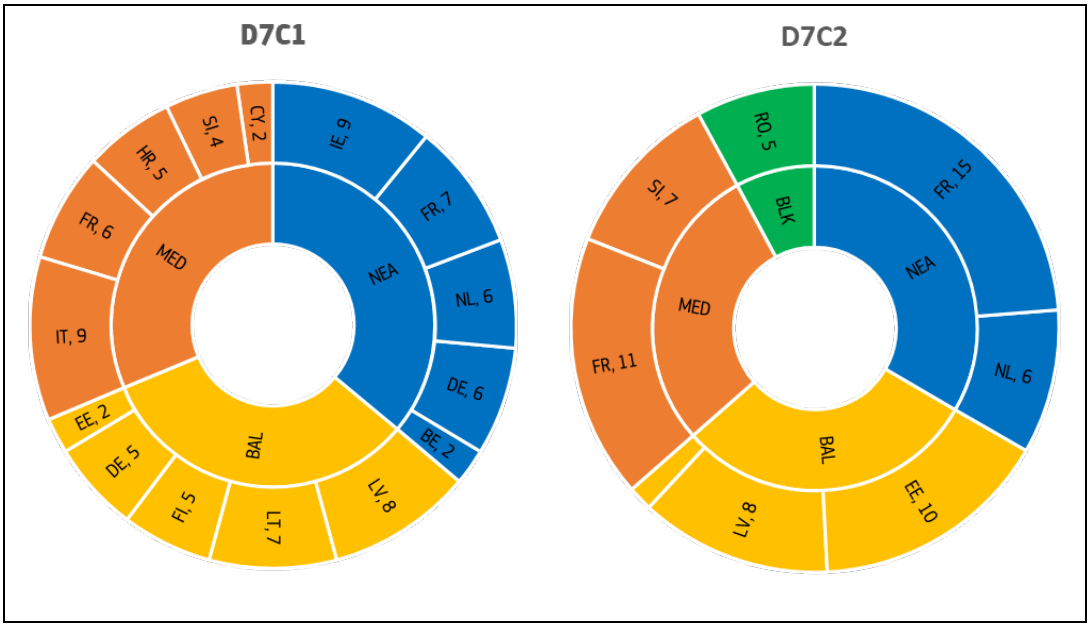


Figure 6. Number of elements reported by MS per marine region and criterion (ES, DK and SE not included as they reported grouped regions).

The only parameter consistently reported across MS was 'EXT', followed by 'other'. Most other parameters were either indicated by 1 or maximum 2 MS per marine region, showing a great variability (Figure 7). DK, ES, and SE, which are not included in the figure, reported respectively 1, 1 and 2 parameters for both D7C1 and D7C2.

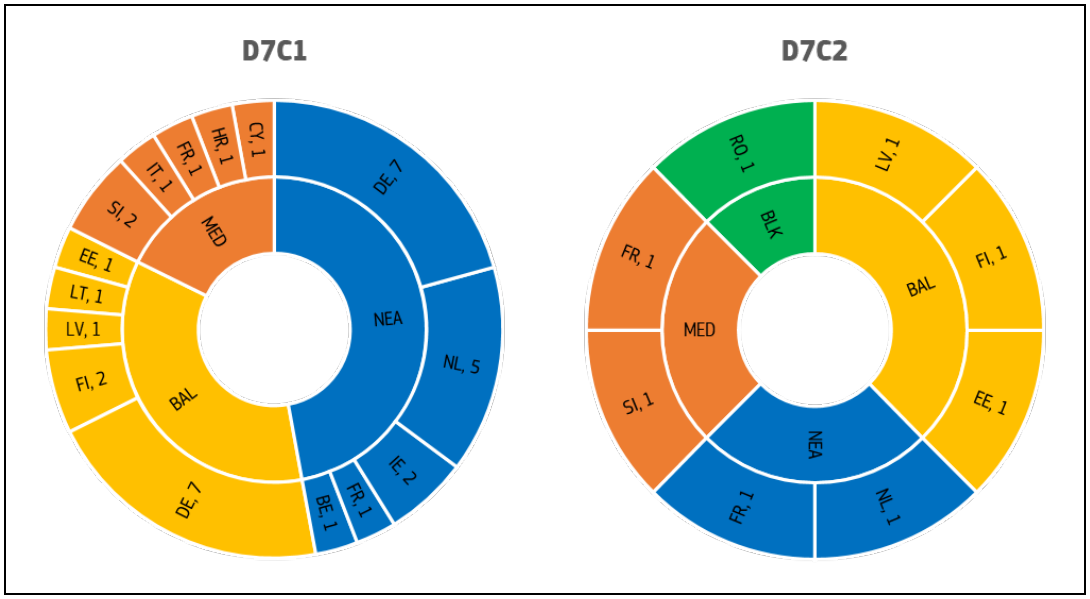


Figure 7. Number of parameters reported by MS per marine region and criterion (ES, DK and SE not included as they reported grouped regions).

D8

The number of elements and the parameters used not only differs across MS, but, as seen in Figure 8, also within the marine regions. For instance, in the Atlantic region, while DE and NL monitor a great number of elements in water, this matrix is not used by FR for any element and other countries in this region usually monitor the contaminants in biota and/or sediments. Biota and sediments are also the preferred matrices for DK and SE (although these two MS are not included in the graph). Indeed, water is not reported for any contaminant by DK, and SE only considers this matrix for the monitoring of radionuclides.

In the Baltic region, the three matrices (water, biota and sediments) are frequently monitored, although there are differences in the number of considered elements (e.g., DE monitors 97 substances in water while LV only one).

Similarly, in the Mediterranean, biota and sediments are the most frequent matrices, although it is difficult to represent since both IT and SI only report on a single element 'all contaminants'. Moreover, the graph does not include ES (which reports on a single category MED/NEA), but this country monitors sediments and biota, while water is not reported for any substance.

On the contrary, biota is not monitored by RO in the Black Sea.

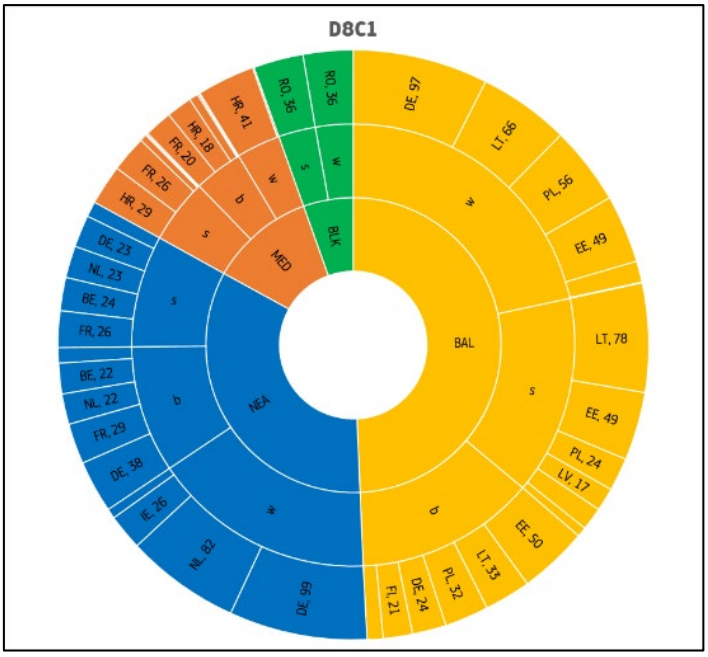


Figure 8. Number of D8C1 elements reported by MS per marine region and matrix (w: water, b: biota, s: sediment). MS with less than 18 elements have not been spelled out (ES, DK and SE not included as they reported grouped regions).

For D8C2, there is only harmonisation in relation to the monitoring of imposex by MS (DE, DK, ES, FR, IE, NL, SE) in the Atlantic region.

D9

Figure 9 shows the consideration of the contaminants regulated under Foodstuffs Regulation 1881/2006 by MS per region. In this graph, DK, ES, and SE have been included as the number of D9 elements is not high and it has been possible to check for each of them the Marine Reporting Unit (MRU) and so differentiate the region those MS are referring to.

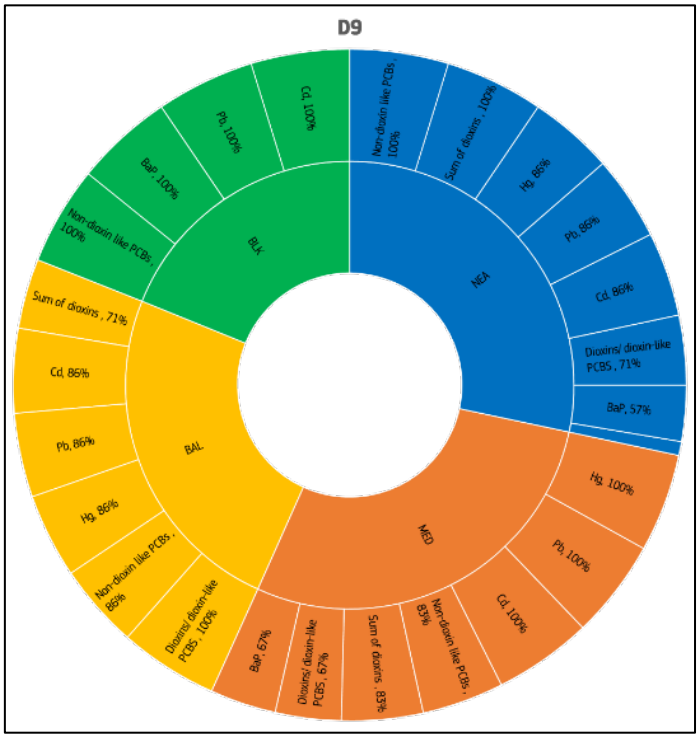


Figure 9. Percentage of MS that consider the contaminants of Food Reg. 1881/2006 in their monitoring programmes per marine region (all 17 MS reporting on D9 are included).

Coherence in the coverage of those elements across MS in the marine region is generally high, in particular for metals, dioxins and PCBs. The monitoring of metals is done by all MS and only SE does not consider those substances to pose a potential risk for human health. Regarding PAHs, none of the Baltic MS report benzo(a)pyrene under D9, and there are slight differences in their consideration within the other regions (MED and NEA).

D10

MS mainly reported the elements (litter categories) described in the GES Decision for D10C1, D10C2 and D10C3. The number of elements for primary criteria, D10C1 and D10C2, does not differ widely across MS in the marine regions BAL, MED and NEA (Figure 10 and Figure 11), except for MS that only considered the element 'Macrolitter (all)' or 'Litter in the environment' in relation to D10C1 (BE, CY, EE, RO). The elements were consistently considered by MS for the different environmental compartments with only slight differences. For instance, the environmental compartments that MS are required to monitor for each of the primary criteria, according to the GES Decision, show a slightly wider coverage (i.e., Coastline for D10C1, and the surface layer of the water column and seabed for D10C2). Moreover, some MS considered other parameters such as the mass (NL), or the water column (ES) itself beyond the surface layer.

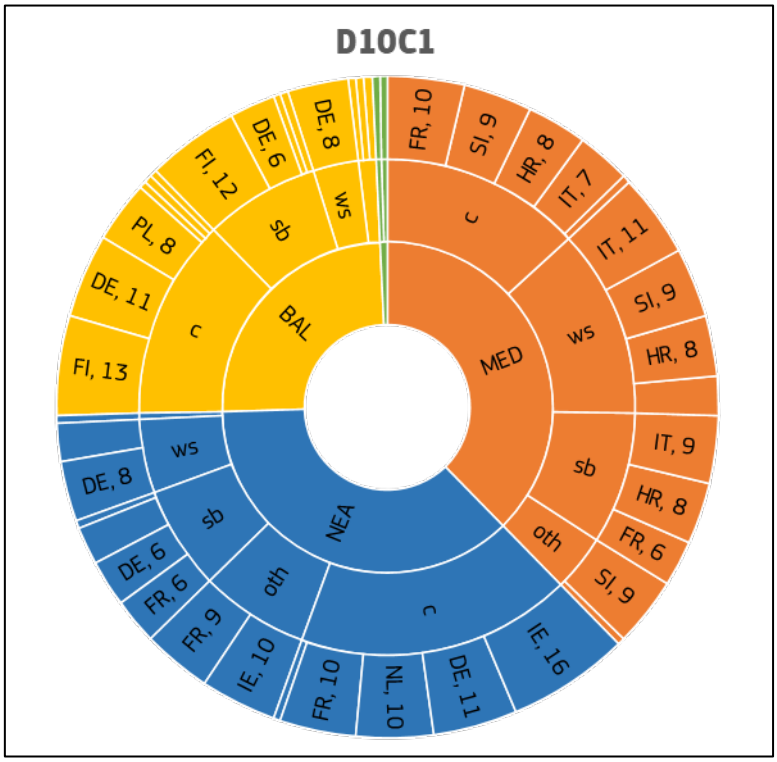


Figure 10. Number of D10C1 elements reported by MS per marine region and environmental compartment (c: coastline, ws: surface layer of the water column, sb: seabed, oth: other, mass: mass). MS with less than 5 elements have not been spelled out: BAL: EE-c, EE-sb, EE-oth, FI-oth, LT-c, LT-sb, LV-c, LV-oth; BLK: RO-c, RO-sb; MED: CY-c; NEA: BE-c, BE, sb, NL-sb, NL-mass) (ES, DK and SE not included as they reported grouped regions).

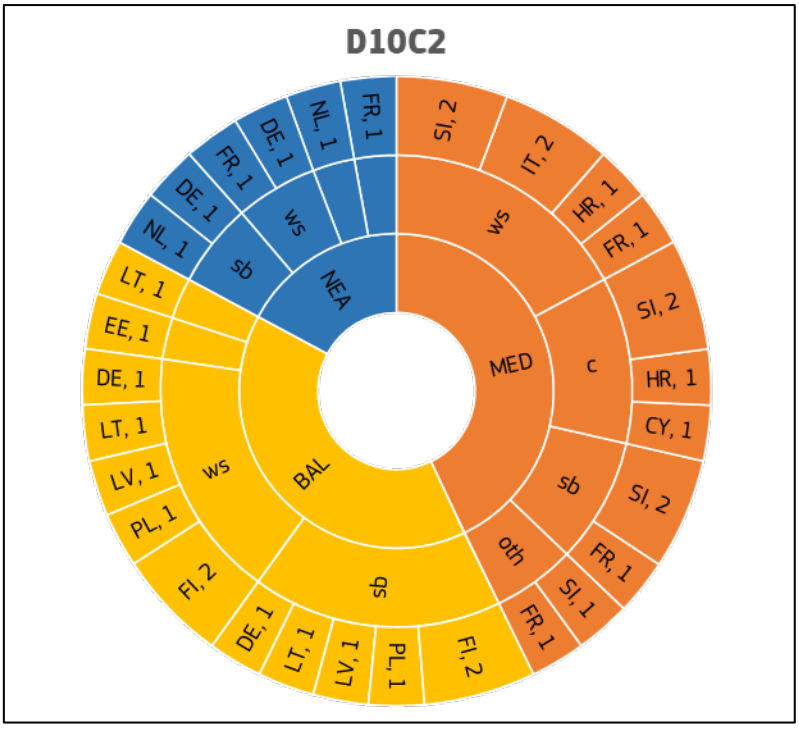


Figure 11. Number of D10C2 elements reported by MS per marine region and environmental compartment (c: coastline, ws: surface layer of the water column, sb: seabed, mass: mass, oth: other) (ES, DK and SE not included as they reported grouped regions).

For the secondary criterion D10C3, the elements reported by MS in the MED and NEA regions do not differ widely (Figure 12), while this criterion was less reported in the BAL region. Mass (CY, DK, ES IT, NL, SI) and the amount of litter in biota (BE, DE, FR) were the main parameters reported. In this context, each MS reported in relation to a different methodology, hindering the analysis of comparability. Furthermore, as indicated in the previous section, only DE reported the group of species monitored in their description of the monitoring programme.

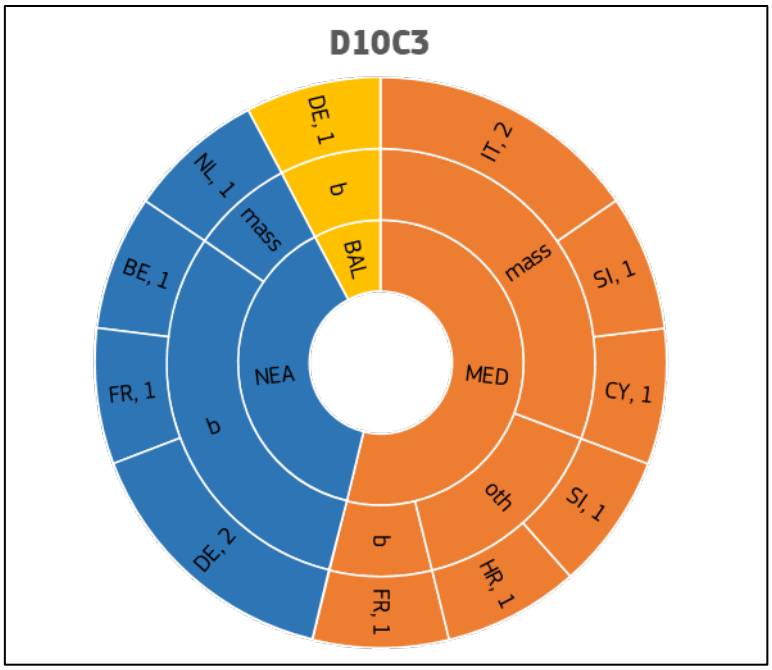


Figure 12. Number of D10C3 elements reported by MS per marine region and environmental compartment (b: amount in biota, mass: mass, oth: other) (ES, DK and SE not included as they reported grouped regions).

D10C4 was considered by 4 MS (DE, EE, FR, SI) and only one of them (DE) reported on adverse effects through

the mortality 'MOR' parameter and the related feature 'PresEnvAdvEffectsSpp'.

Overall, features, parameters and elements were consistently considered by MS for the primary criteria in all regions, while for the secondary criteria, further coverage and harmonisation of monitoring programmes are needed to ensure comparability.

D11

The most relevant Features for D11C1 and D11C2 ('PresEnvSoundImpulsive' and 'PresEnvSoundContinuous') are reported consistently by MS across the marine regions. A small proportion of MS also indicated relevant activities within the features listed under D11 (i.e., 'ActivTranspShip' in all but the BLK region and 'ActivMilitary' and 'ActivResearch' in the BAL and NEA regions). Relevant parameters reported by MS for D11C1 and D11C2 follow a similar pattern (Figure 13).

DK, ES and SE reported respectively for 4, 1, and 1 features for D11C1, and 2, 1, and 2 features for D11C2. These three MS reported the parameters DUR and LEV-N for D11C1, with ES also reporting on 'other', while for D11C2 DK and SE reported for the parameter SPL, and ES and SE reported 'other'.

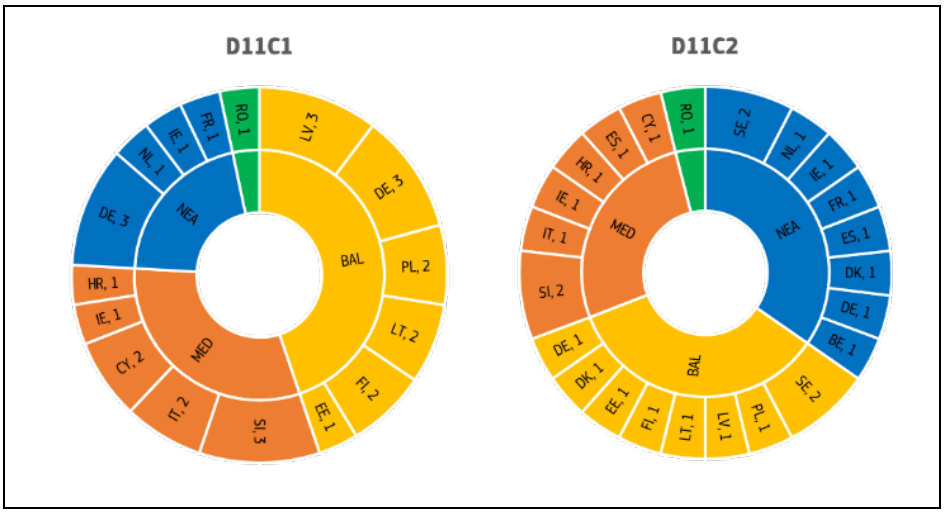


Figure 13. Number of parameters reported by MS per marine region and criterion (ES, DK and SE not included as they reported grouped regions).

Consistently with the reporting guidelines, all MS across each marine region indicated 'Not Applicable' for elements under D11C1. As for D11C2, the three frequency bands relevant for monitoring continuous sounds were indicated more homogeneously by MS in the BAL region, while no MS in the NEA region and the MED regions indicated the frequency band centered on 2000 Hz (Figure 14). In the BLK region, 'Not Applicable' was indicated for both criteria.

DK and SE reported the three frequency bands, while ES only considered the frequency bands centered at 63 and 125 Hz.

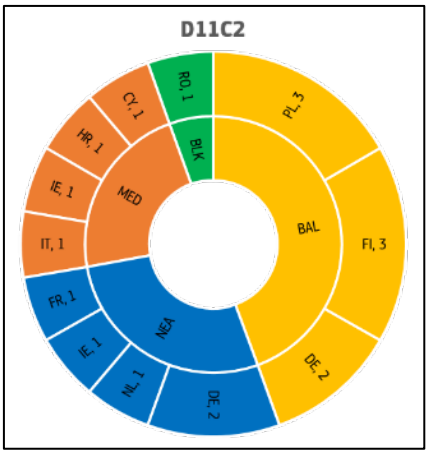


Figure 14. Number of D11C2 elements reported by MS per marine region (ES, DK and SE not included as they reported grouped regions).

D1-Marine Mammals

Figure 15 shows the number of marine mammal's species monitored by MS in each marine region for the different D1 criteria.

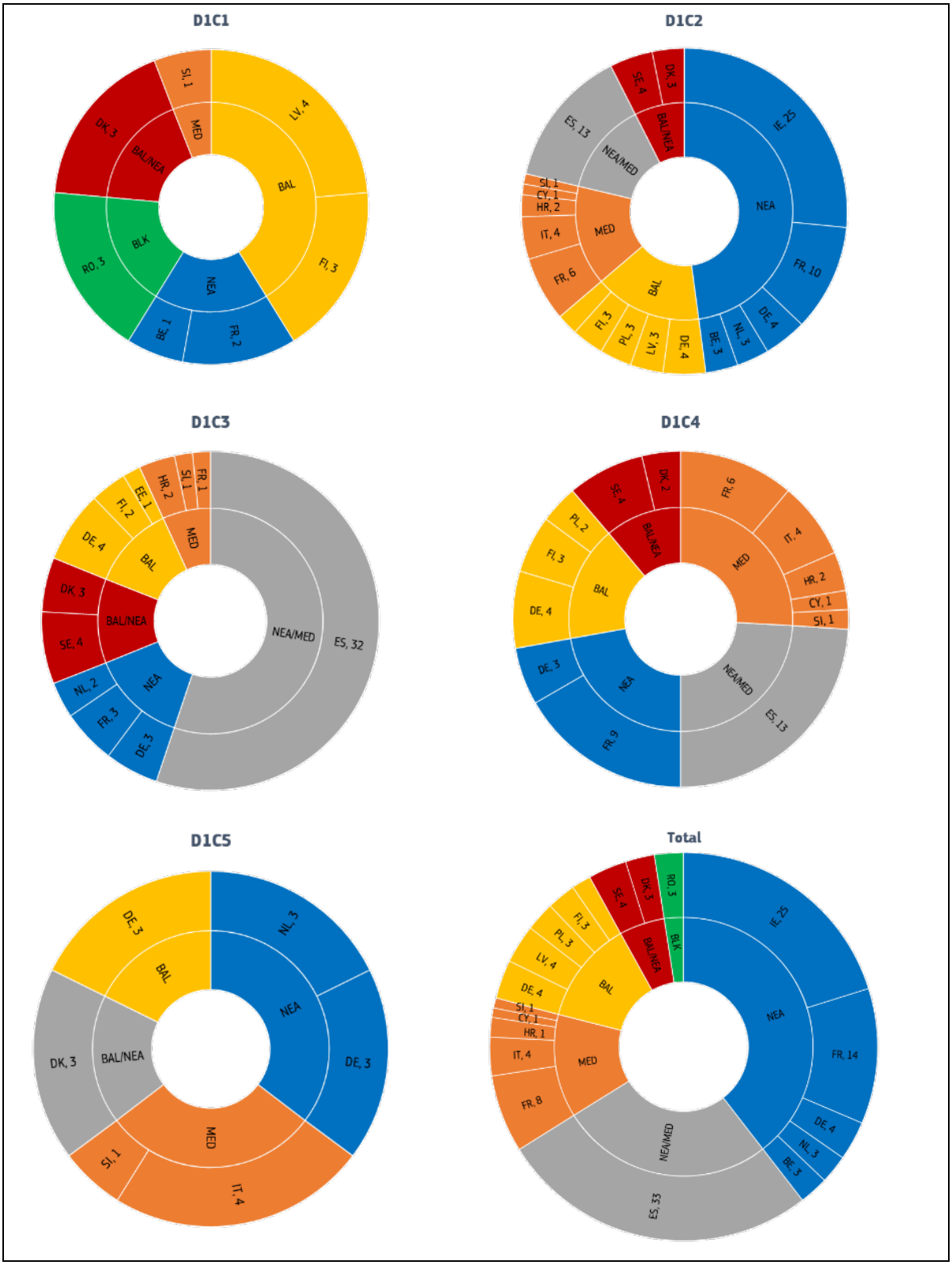


Figure 15. Number of elements (marine mammal's species) reported by MS per marine region and criterion.

D1-Marine Reptiles

Figure 16 shows the number of marine reptile's species monitored by MS in each marine region.

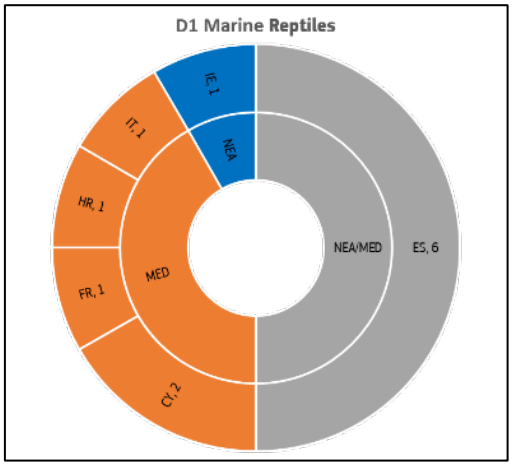


Figure 16: Number of element (marine reptile's species) reported by MS per marine region.

D1-Fish and Cephalopods

Figure 17 shows the number of MS reporting different features in each marine region and Figure 18 the number of marine fish and cephalopod's species monitored by MS in each marine region. Additionally, Figure 19 shows the number of fish species reported by MS in each marine region for the different D1 criteria.

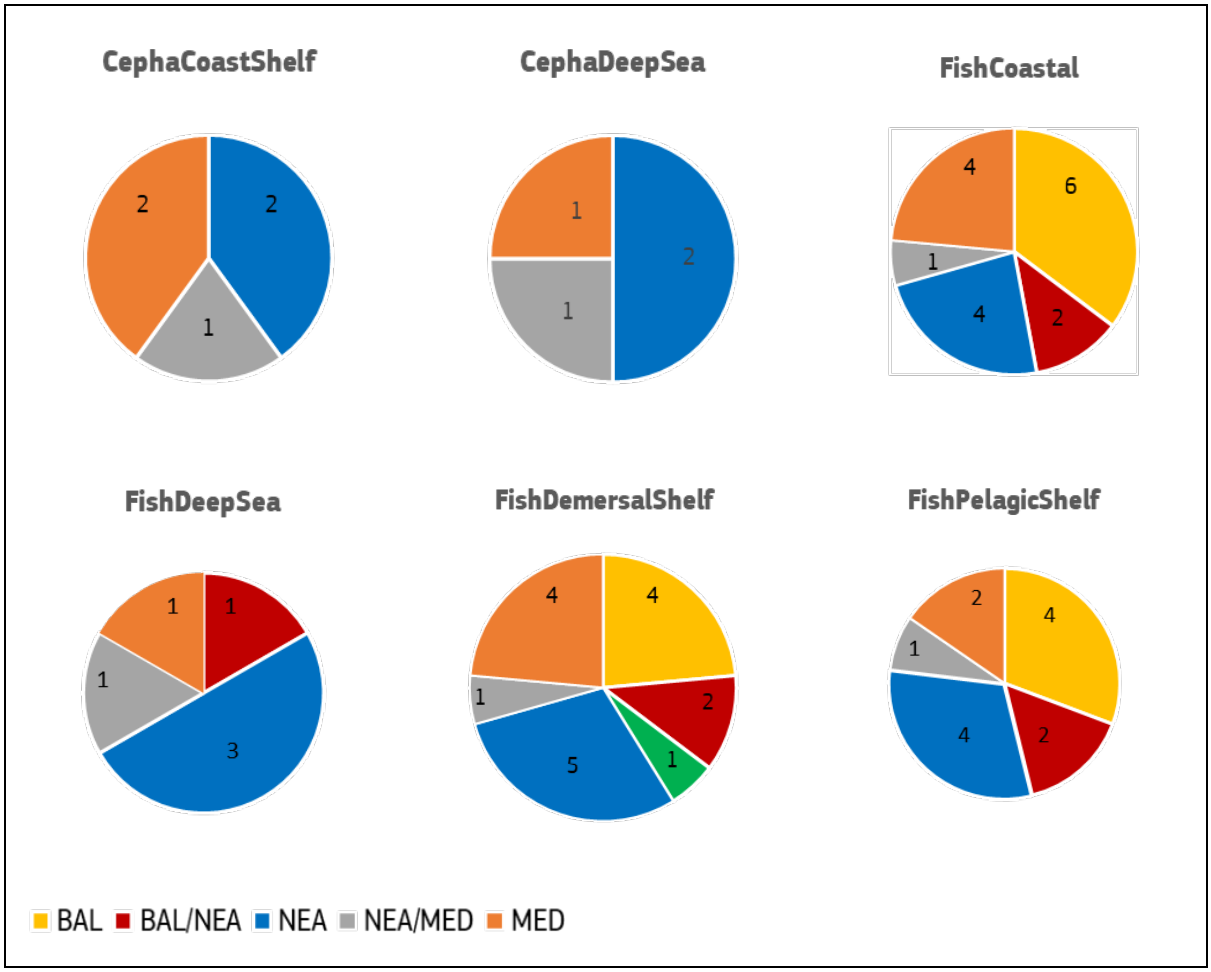


Figure 17: Number of MS reporting different features for fish and cephalopods per marine region.

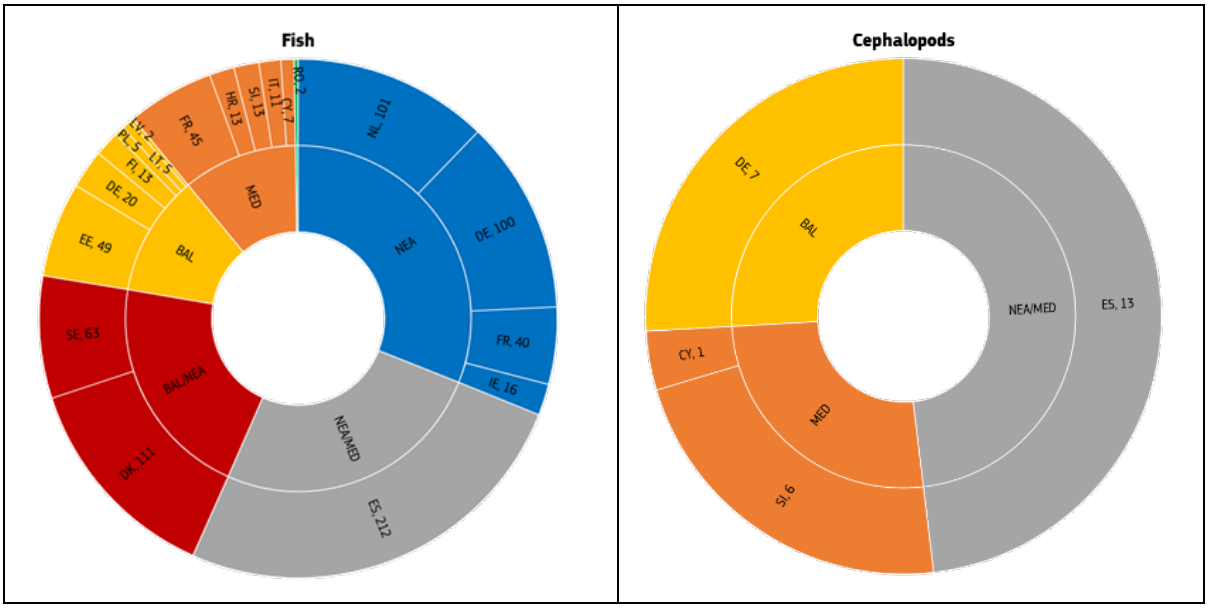
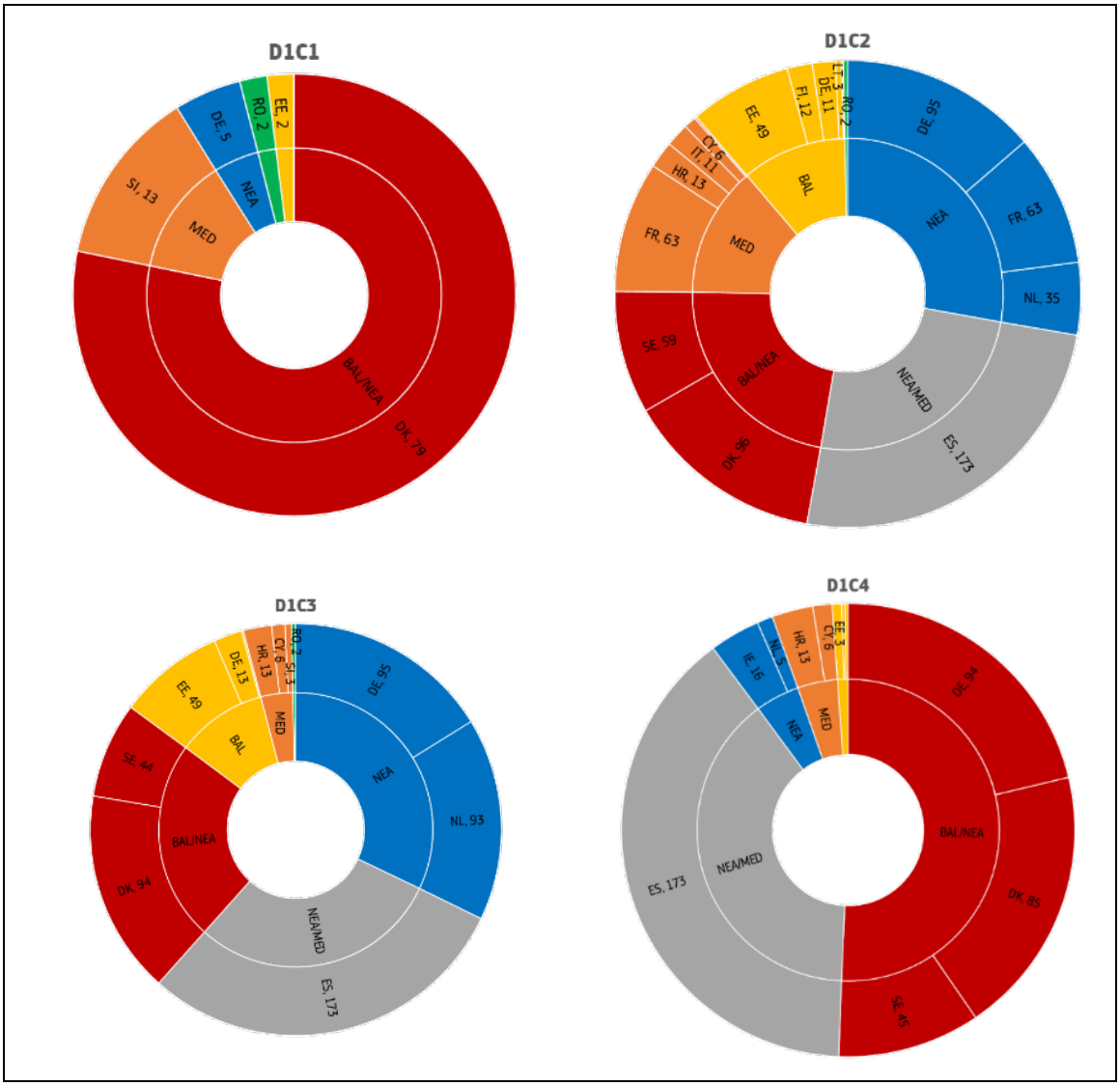


Figure 18: Number of fish and cephalopod's species reported by MS per marine region.



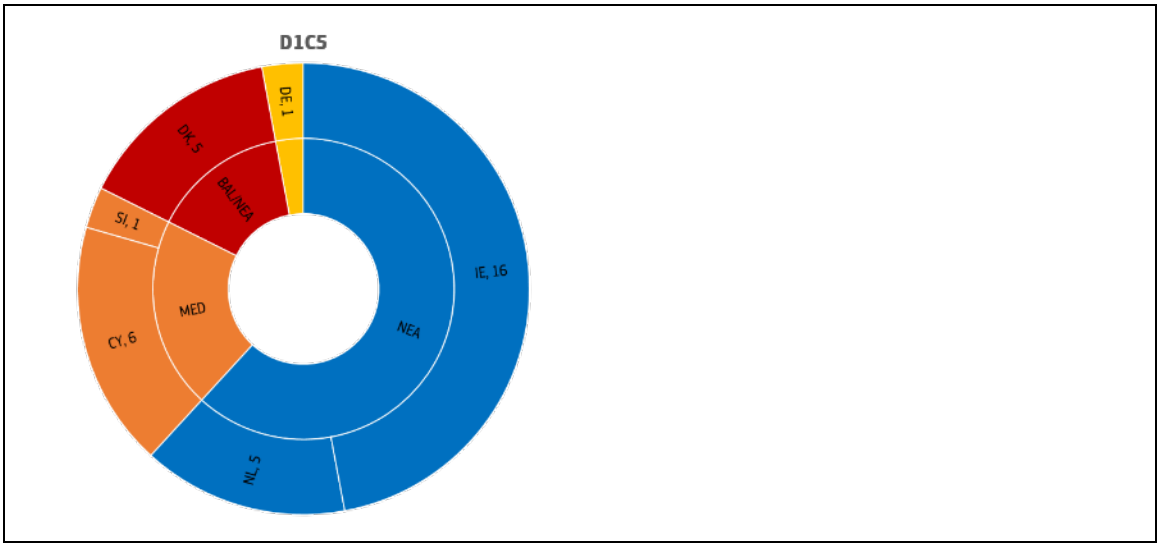


Figure 19. Number of elements (fish species) reported by MS per marine region and criterion.

D1-Seabirds

Figure 20 shows the number of MS reporting features for each seabird species group across the marine regions.

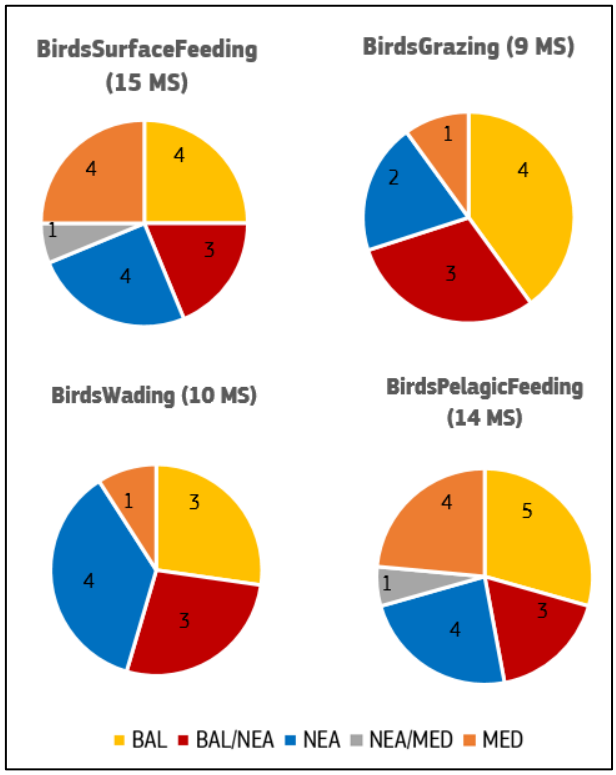


Figure 20. Number of MS reporting different features for seabird species per marine region.

Figure 21 shows the total number of bird's species (elements) reported by the 16 MS reporting on D1-seabirds. There is high variability among MS, from reporting one (CY and SI) to many species (e.g., 120 by IE, 74 by DK and 73 by DE). Moreover, there is unbalanced monitoring across the regions, where the MED has very few monitoring programmes compared to BAL and NEA. Unfortunately, there is no input from the Black Sea (Annex I, Table A20).

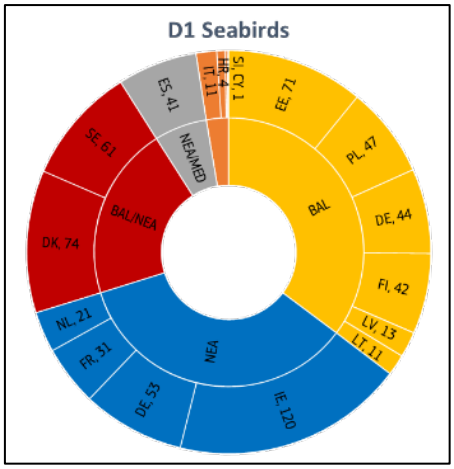


Figure 21. Number of seabird's species reported by MS per marine region.

Some discrepancies were noted in the reporting of species. In the NEA, BE reported only species groups (e.g., grouped benthic-feeding birds), without specifying the elements. Some MS (DK, ES, LT, PL) grouped species in the same family and reported the family, e.g., *Gavia sp*. These inconsistencies in the reporting should be considered in the overview of the results.

Figure 22 shows the number of seabird's species reported for each D1 criteria in the different regions.

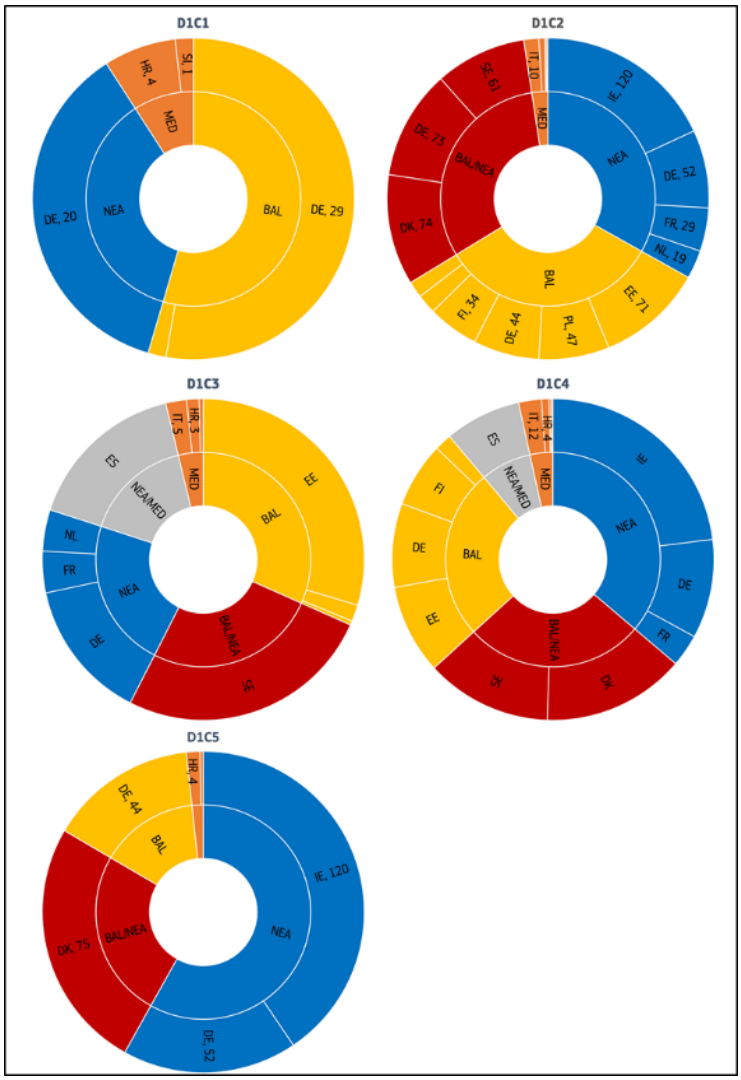


Figure 22. Number of elements (seabird's species) reported by MS for all features per marine region and criterion.

D1-Pelagic Habitats

D1C6 is overall well monitored across MS and region regarding the required elements and compared to other biodiversity themes (species, food-webs and benthic habitats) (Figure 23). However, the MSFD expert network on pelagic habitats has only recently started the work to harmonise elements, assessments and monitoring and the outcome of this work is not yet reflected in the MS monitoring.

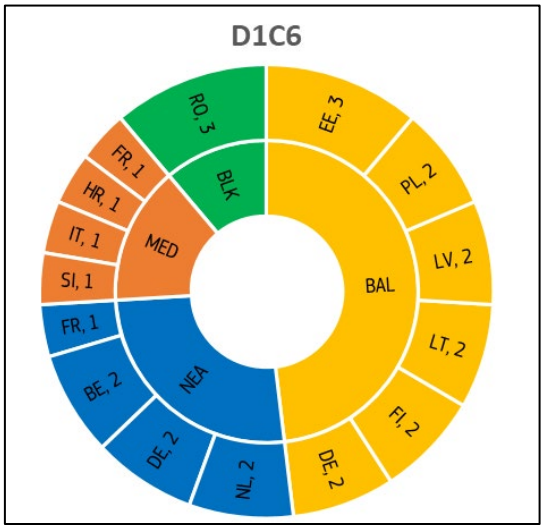


Figure 23. Number of D1C6 elements reported by MS per marine region (ES, DK and SE not included as they reported grouped regions).

D4

The number of elements reported differs across MS, but also within marine regions (Figure 24). For instance, for D4C1, in the Baltic region, FI and EE report 7 TGs while PL only 2. In the Mediterranean, IT reports 54 and HR reports 4. DK and SE reported 27 and 24 TGs, respectively, under NEA/BAL region, while ES reported 21TGs under MED/NEA. As it was not possible to split these values per region, these MS are not included in the graphical representation below.

For D4C2, in the Baltic region, FI reports 10 TGs and EE 8 TGs while in the Mediterranean, IT reports 54 and HR reports 6 TGs. Again, DK (27 TGs), SE (32 TGs) and ES (21 TGs) for "mixed" regions.

For D4C3, in the Baltic region, FI reports 3 TGs, LT 2 and PL 1 TG. In the Mediterranean HR and SI report respectively 2 and 1 TG. NL reports 2 TGs in the NEA region. DK and SE report respectively 27 and 8 TGs in the BAL/NEA and ES reports 21 TGs in the MED/NEA. As for D4C4, in the Baltic region, FI reports 2 TGs and EE reports 1 TG, HR reports 4. DK and SE report respectively 27 and 5 TGs in the BAL/NEA and ES reports 21 TGs in the MED/NEA.

Figure 24 Number of elements reported by MS per marine region and criterion. MS with only one element (LT, in BAL and SI in MED) have not been spelled out (ES, DK and SE not included as they reported grouped regions).

D6

Generally, the elements and criteria for D6 are well covered by the MS. Not all MS reported all criteria (Figure 25), however the ongoing work of the TG Seabed aims to further harmonise the monitoring and assessment of the agreed criteria, including regional cooperation.

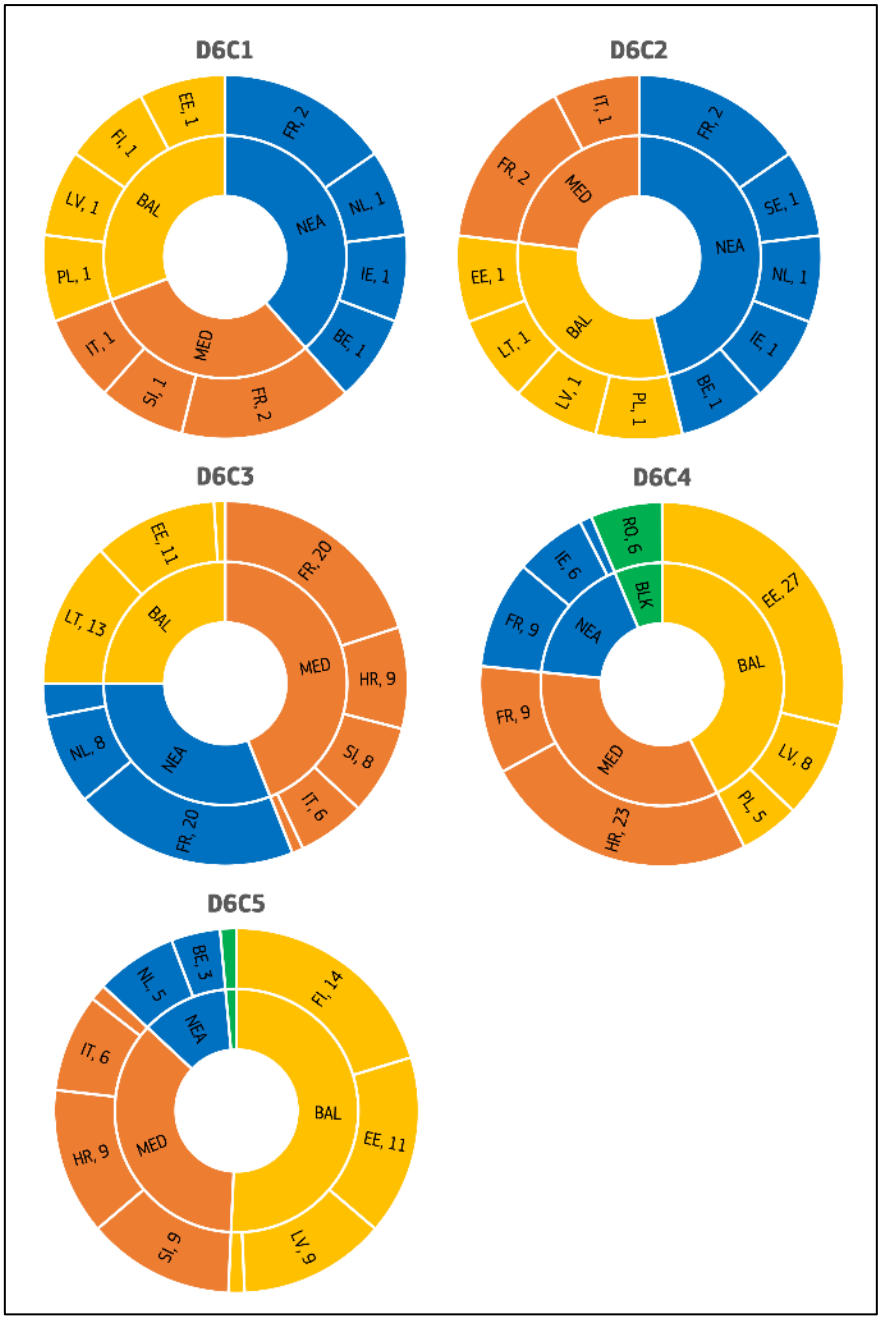


Figure 25. Number of elements reported by MS per region and criterion (ES, DK and SE not included as they reported grouped regions).

4.1.2 Coverage of criteria (primary, secondary) for the descriptor

Figure 26 shows the number of MS that cover the different descriptor criteria in their monitoring programmes.

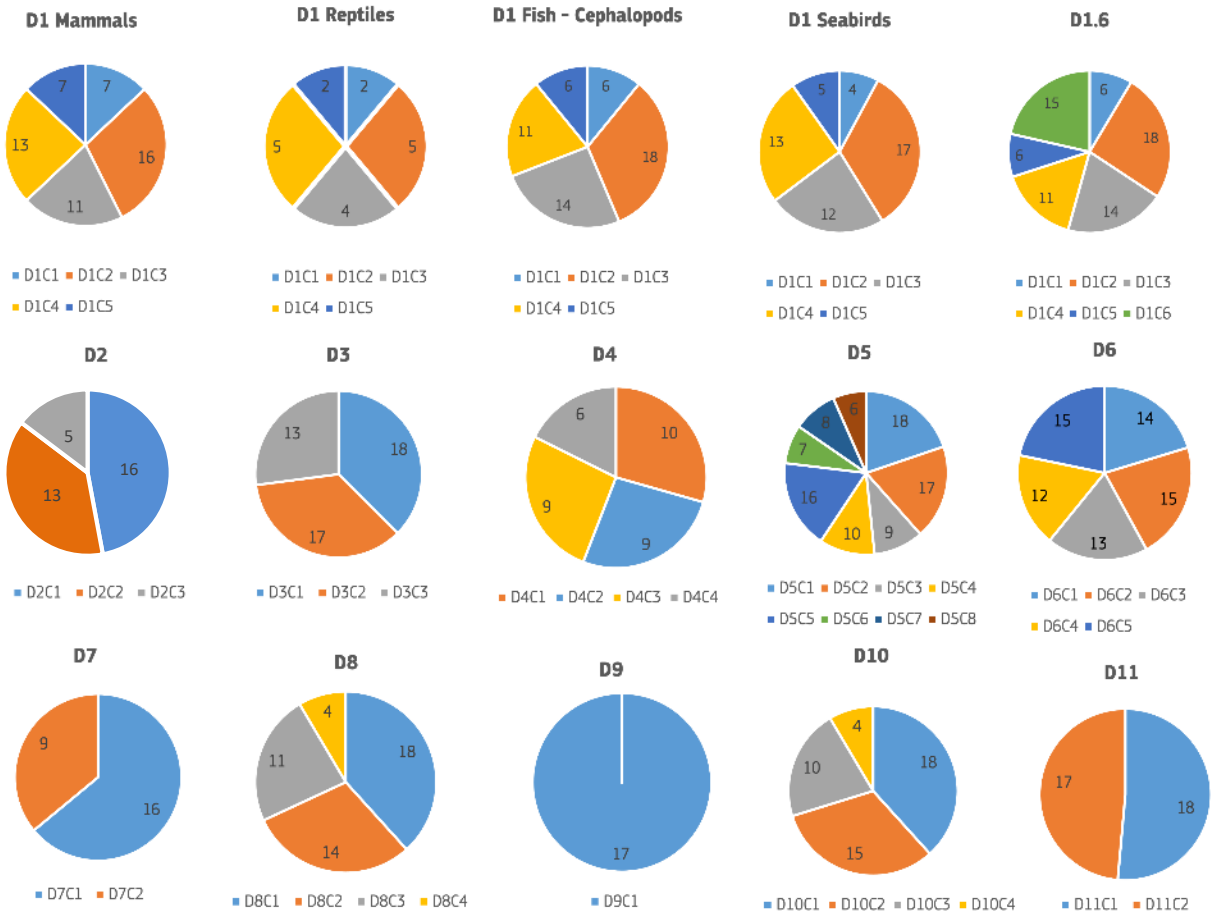


Figure 26. Number of MS monitoring the different criteria of all MSFD descriptors.

D2

All 18 MS have reported on D2: 16 MS on D2C1 (BE, DE, DK, EE, ES, FI, FR, HR, IE, LT, LV, NL, PL, RO, SE, SI), 13 MS on D2C2 (CY, DK, EE, ES, FI, FR, IT, LT, LV, PL, RO, SE, SI) and 5 on D2C3 (EE, LT, PL, RO, SI).

D3

All 18 MS reported on D3C1, 17 on D3C2 (LV missing) and 13 on D3C3 (LV, FR, ES, IE, and NL missing). By checking the 'Parameters' field, it appeared that LV reported on D3C2 and D3C3 using either a wrong feature category ('ActivExtrLivingFishHarv') or using 'not relevant' under 'GESCriteria', hence these entries were filtered out from the analysis.

D5

The primary criteria D5C1, D5C2 and D5C5 were reported by 18, 17 (PL missing) and 16 MS (BE and LV missing), respectively. The secondary criteria D5C3 and D5C4 were reported by 9 (DE, EE, ES, FI, HR, LV, RO, SE, SI) and 10 MS (DE, DK, EE, ES, FR, HR, LT, PL, RO, SE, SI), respectively.

D7

D7C1 was reported by most (16) MS (all but PL and RO), while D7C2 by only 10 MS (DK, EE, ES, FI, FR, LV, NL, RO, SE, SI). 7 MS (EE, ES, FR, IE, LT, PL, SE) also indicated further features and parameters that were categorized as 'not relevant' or a null value under 'GES criteria' reporting field. In some of these cases (EE, ES, SE), the corresponding monitoring programmes are very broadly related with the descriptor, as they are generally aimed to collect data on human activities that directly or indirectly affect the marine environment, from aquaculture to input of litter and sound (among others). In other cases (ES, FR, IE, LT, PL), the relative programmes are aimed to collect general data on the chemical and physical characteristics of the marine waters, and thus can be broadly associated with D7C1.

D8

D8C1 is the only criterion considered by all the 18 MS. 14 MS (BE, DE, DK, EE, ES, FI, FR, HR, IE, IT, LV, NL, PL, SE) also cover D8C2 and 11 MS (BE, DK, EE, ES, FI, HR, IE, LV, NL, SE, SI) cover D8C3. HR includes this criterion (D8C3) in the monitoring programmes, although indicating that due to the lack of methodological standards, it is not considered for D8 assessment of environmental status.

Only 4 MS (EE, ES, FR, SE) cover D8C4. EE reports the density of dead waterbirds (individuals/ km) and the proportion of oil-stained waterbirds of all found waterbirds (which should be related to D8C4) under the D8C3 monitoring programme description. BE includes the proportion of oiled stranded guillemots under D8C2 monitoring and indicates as a D8C1 gap the need for a common regional approach at Bonn Agreement and OSPAR level with respect to post-incident effect monitoring of significant acute pollution (D8C4).

Moreover, 6 MS (EE, FI, FR, IE, PL, SE) also report sometimes 'not relevant' under the reporting field 'GEScriteria'. In some of these cases, the corresponding monitoring programme is not linked to D8 (e.g., IE refers to remote sensing-chlorophyll a). In other MS, the corresponding programme is related to the monitoring of contaminants, but is described in a general way, making it difficult to assign to a specific criterion. For instance, in EE, 'GEScriteria' is reported as 'not relevant' for one monitoring programme that aims to collect data on a number of human activities that directly or indirectly affect the marine environment (such as offshore structures, aquaculture, mining etc.). This programme has 23 different associated parameters, of which only one refers specifically to contaminants (pollution load (tonnes/year) of metals). In FR, 'not relevant' is reported under 'GEScriteria' for monitoring prgrammes that refer generally to the inputs of chemical contaminants from rivers, the monitoring of acute pollution due to polluting substances and their harmful effects on the health of species and the state of habitats. In SE, those monitoring programmes relate to the input of contaminants from atmospheric and land-based sources, the health of marine mammals and levels of contaminants in biota. In other cases, however, although 'GEScriteria' is reported as 'not relevant', the corresponding parameters or programme description allow the understanding of what D8 criteria is aimed at (and consequently they are considered in the graph above). For instance, FI reports parameters related to D8C2 (lysosomal activity) and PL reports parameters related to D8C2 (micronucleus test - genotoxicity index and externally visible fish diseases) and to D8C3 (average annual spill volume).

D9

D9 only has one criterion (D9C1), which is considered by 17 MS (as said above, DE does not report any monitoring programme for D9).

D10

Coverage varies widely across primary and secondary criteria. All the 18 MS reported on D10C1 and 15 MS (all but BE, IE, RO) on D10C2. In contrast, secondary criteria were considered by only 10 MS (BE, CY, DE, DK, ES, FR, HR, IT, NL, SI), in the case of D10C3, and by 4 MS (DE, EE, FR, SI) for D10C4.

Only 2 MS (EE, FR) occasionally reported 'not relevant' under the 'GEScriteria' field. The corresponding monitoring is sometimes linked to human activities that may potentially affect the environment. For instance, EE aims to report data on military or mining related activities categorised and FR refers mainly to monitoring programmes that consider the total set of macrolitter 'Macrolitter (all)' in different environmental compartments. In addition, FI reports human activities related to waste treatment and disposal for D10C1, which allows the understanding of the specific aim of the reported monitoring programme.

Other MS (EE, IE) report under 'GEScriteria' monitoring programmes related to other descriptors and it is complex to determine the direct relationship with monitoring programmes specific for D10. For instance, IE reported under D10, information on the distribution of deep-sea fish species for D1C4 or the mortality rate of commercial species for D3C1, but there are no reported monitoring programmes covering the relevant and potentially related criteria D10C3 and D10C4. Moreover, EE and ES reported under 'GEScritera' blank fields, mainly related to programmes aiming to determine the pressure levels and impacts in marine environment, such as, acute pollution events, eutrophication, and the impulsive sound in water or litter in the environment.

D11

D11C1 is covered by all the 18 MS, while D11C2 by 17 MS (all by IE). 4 MS (EE, ES, FR, SE) also indicated further features and parameters that were categorized under 'not relevant' or a null value in the 'GES criteria' reporting field. In some of these cases, the corresponding monitoring programme is not linked to D11, or is very broadly related with it, making it difficult its assignment to a specific D11 criteria. For instance, EE reported as 'not relevant' one monitoring programme aimed to collect data on a number of human activities that directly or indirectly affect the marine environment and which has 23 different associated parameters (of which only one refers specifically to marine noise). FR reported as 'not relevant' for the feature 'PresInputSound'. ES and SE listed a series of features for the 'GEScriteria' reported as 'not relevant', but without indicating any associated parameter.

D1-Marine Mammals

For marine mammals, primary criteria are D1C1 (although baleen whales and deep diving toothed whales are not subjected to bycatches), D1C2, D1C4 and D1C5, since all marine mammals are covered by Annexes II, IV or V to Directive 92/43/EEC. D1C3 is a secondary criterion, however, it provides essential information for the population structure and viability.

D1-Marine Reptiles

For marine turtles, primary criteria are D1C1, D1C2, D1C4 and D1C5. D1C3 is a secondary criterion although it provides essential information for the population structure. As shown in Figure 26, not all criteria are equally addressed in the monitoring programmes. The most reported criteria for this species group reflect the data availability or monitoring programmes that comes from the Habitats Directive (HD) and covers D1C2 and D1C4, rather than the primary or secondary nature of criteria, since D1C1 is hardly reported or monitored, despite being included in the data that MS should collect for the Common Fisheries Policy (CFP).

D1-Fish and Cephalopods

For fish and cephalopods, primary criteria are D1C1, D1C2, D1C3 and for those species that are included in the HD, also D1C4 and D1C5. Figure 26 shows that not all criteria were equally reported. The most reported criteria for these species groups reflect the data availability or monitoring programmes that comes from the CFP and covers D1C2, D1C3 and D1C4, although the last two criteria were less reported. Major gaps in monitoring seem to be for D1C1 and D1C5, given the number of species. However, it remains to be resolved the proportion of the fish and cephalopods that are impacted by fisheries and the proportion of the fish that are included in the HD and should have monitoring programmes for D1C5.

D1-Seabirds

There are two primary criteria (D1C1: mortality; D1C2: abundance) and three secondary criteria (D1C3: breeding

success; D1C4: distribution; D1C5: habitat conservation) according to the GES Decision. As shown in Figure 26, not all criteria were equally reported to be monitored. The most reported criteria for this species group reflect the data availability or monitoring programmes that comes from the Birds Directive and covers D1C2 and D1C4, rather than the primary or secondary nature, since D1C1 is hardly reported or monitored.

D1 –Pelagic Habitats

D1C6 was reported by 15 MS (BE, DE, EE, ES, FI, FR, HR, IT, LT, LV, NL, PL, RO, SE, SI) and is the second D1 criteria most frequently reported. 1 MS (PL) reported 'not relevant' under the field 'GEScriteria' regarding monitoring programmes for D1C6.

D4

D4C1 is considered by 10 MS (DK, EE, ES, FI, HR, IT, LT, PL, SE, SI), D4C2 by 9 MS (DK, EE, ES, FI, HR, IT, LT, SE, SI), D4C3 by 9 MS (DK, ES, FI, HR, LT, NL, PL, SE, SI) and D4C4 by 6MS (DK, EE, ES, FI, HR, SE). D4 reporting is missing for DE and RO. Moreover, although BE, CY, FR, IE, and LV reported on D4, they didn't report any D4 criteria under the field 'GEScriteria', but other descriptor criteria (mainly D1).

D6

All D6 criteria are primary and are frequently reported, in particular D6C2 and D6C5 (15 MS each: BE, DE, DK, EE, ES, FI, FR, IE, IT, LT, LV, NL, PL, SE, SI).

4.1.2.1 Coherence in the coverage of criteria across MS in the marine region

D2

The primary criterion D2C1 and secondary D2C2 are to some extent monitored across marine regions, while D2C3 is not in the North-East Atlantic region (Figure 27).

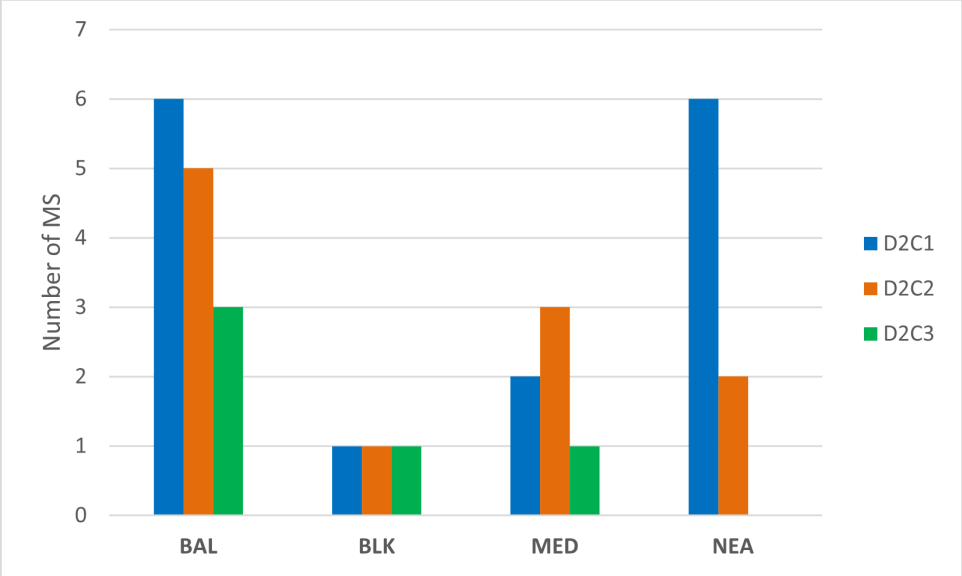


Figure 27. Number of MS reporting on D2 criteria across marine regions (ES, DK and SE not included).

D3

The consideration of D3 criteria within each marine region suggests that the best agreement amongst MS is in BAL (Figure 28). There is just one MS missing D3C2 and D3C3 in BAL (LV), but this seems to be due to a reporting issue rather than a monitoring issue, as explained earlier. For the 3 MS not included in Figure 28 (due to reporting on combined regions), both DK and SE reported on all three D3 criteria for BAL/NEA, while ES reported on just D3C1 and D3C2 for 'MED/NEA'.

MS with no monitoring reported for D3C3 (LV, FR, ES, IE, NL) should fill this gap. MS should also report under the correct 'GESCriteria' (e.g., all LV entries on D3C2 and D3C3 were not tagged as such).

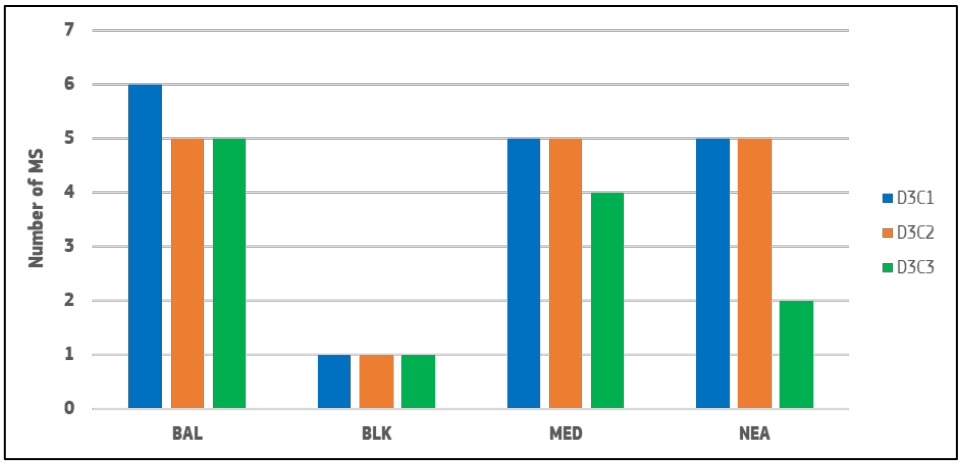


Figure 28. Number of MS reporting on D3 criteria across marine regions (ES, DK and SE not included).

D5

In the Baltic, 6 MS (DE, EE, FI, LT, LV, PL) reported on D5C1, 5 MS (DE, EE, FI, LT, LV) on D5C2 and 5 MS (DE, EE, FI, LT, PL) on D5C5. In the MED region, 5 MS (CY, FR, IT, HR, SI) reported on the primary criteria (D5C1, D5C2 and D5C5), whereas the secondary criteria (D5C3, D5C4, D5C6, D5C7) were reported by 2 MS (HR, SI), and SI also reported on D5C8. In the Atlantic region, D5C1 and D5C2 were reported by 5 MS (BE, DE, FR, IE, NL) and D5C5 by 4 MS (DE, FR, IE, NL). In this region, other criteria were reported by only 1 or 2 MS (Figure 29). DK and SE (not included in the figure) reported on D5C1, D5C2, D5C4 and D5C5 and ES on D5C1, D5C2, D5C3, D5C4 and D5C5

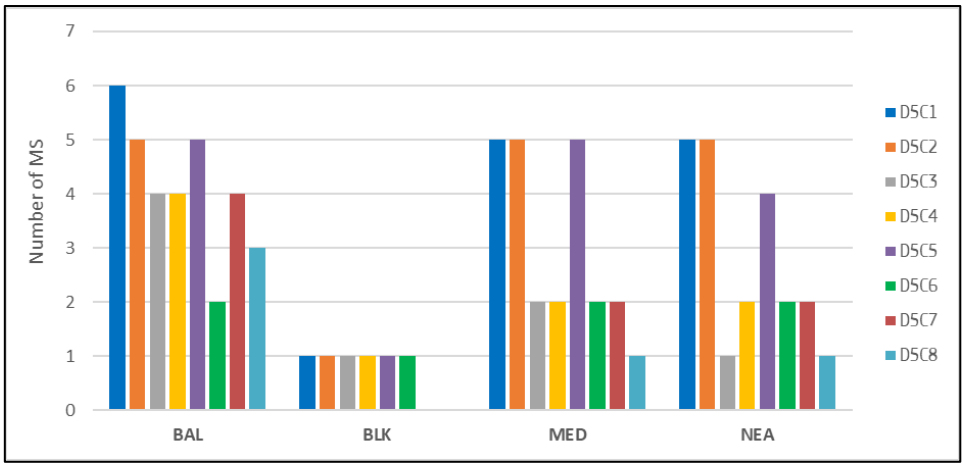


Figure 29. Number of MS reporting on D5 criteria across marine regions (ES, DK and SE not included).

D7

MS did not consistently report D7 criteria across the marine regions (Figure 30). Indeed, D7C1 is the criterion most reported in most marine regions, with the exception of BLK, where only D7C2 is reported. DK, ES, SE, not shown in the figure, reported for both D7C1 and D7C2 criteria.

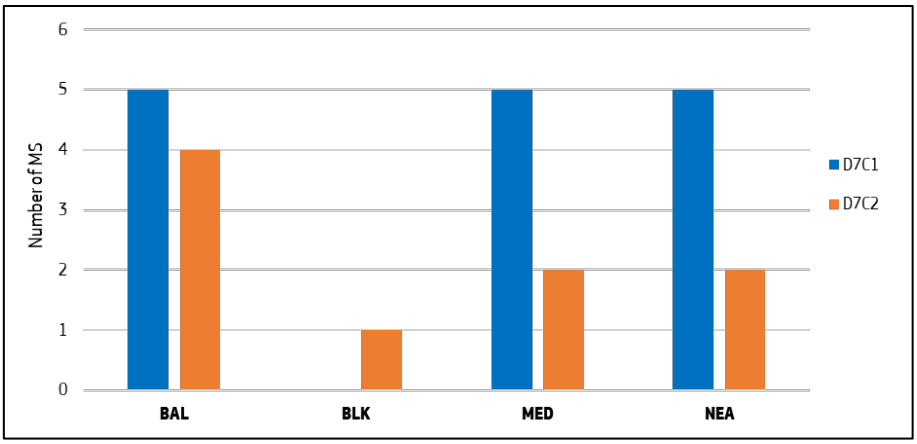


Figure 30. Number of MS reporting on D7 criteria across marine regions (ES, DK and SE not included).

D8

Figure 31 shows the consideration of D8 criteria within each marine region. It can be seen that harmonisation is generally high regarding D8C1 coverage in all regions and in the Baltic and especially in the Atlantic also regarding D8C2.

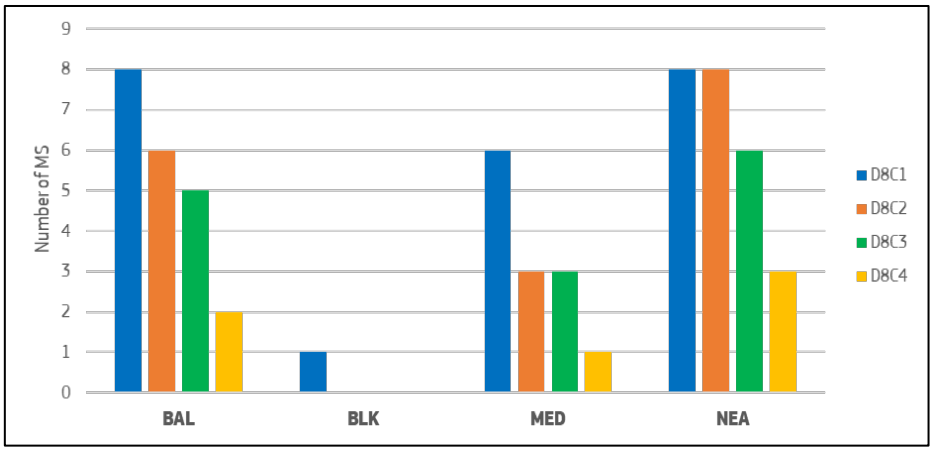


Figure 31. Number of MS reporting on D8 criteria across marine regions (all 18 MS are considered).

D9

As said above, there is only one criterion for D9 and the 17 MS reporting on D9 (all but DE) consider it.

D10

MS reported consistently primary criteria D10C1 and D10C2 within each marine region (Figure 32). The secondary criterion D10C3 was mainly considered in the MED and NEA regions. D10C4 was insufficiently covered in all regions, potentially because of the current lack of harmonised indicators and/or monitoring methodologies, as indicated by some MS in their programme descriptions and gaps (e.g., DE, FR).

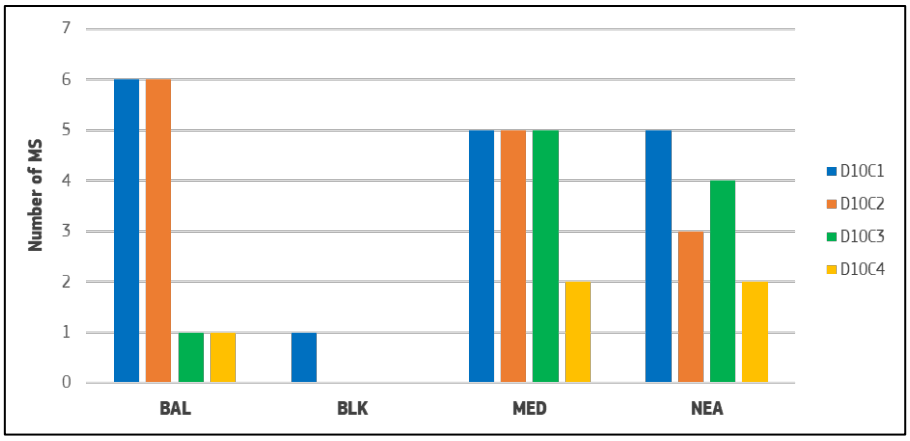


Figure 32. Number of MS reporting on D10 criteria across marine regions (ES, DK and SE not included).

D11

Figure 33 shows the consideration of D11 criteria within each marine region. DK, ES and SE reported for both criteria. In general, MS reported consistently both D11C1 and D11C2 across the marine regions, with the exception of IE, which did not report D11C2 (NEA region).

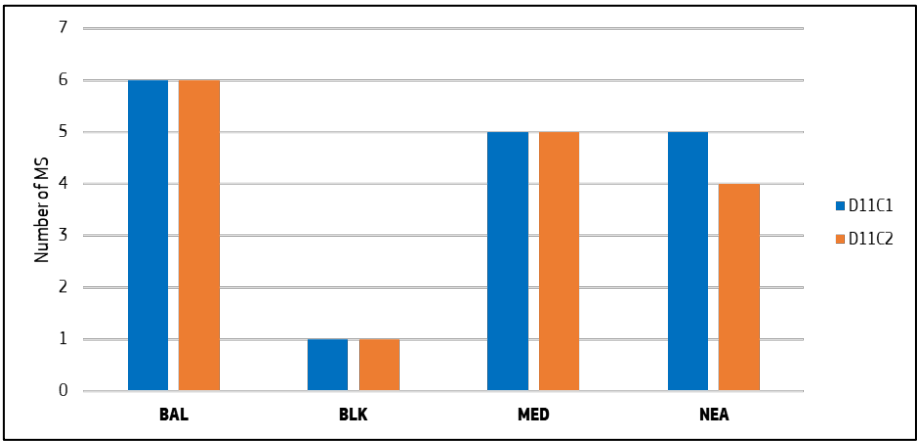


Figure 33. Number of MS reporting on D11 criteria across marine regions (ES, DK and SE not included).

D1-Marine Mammals

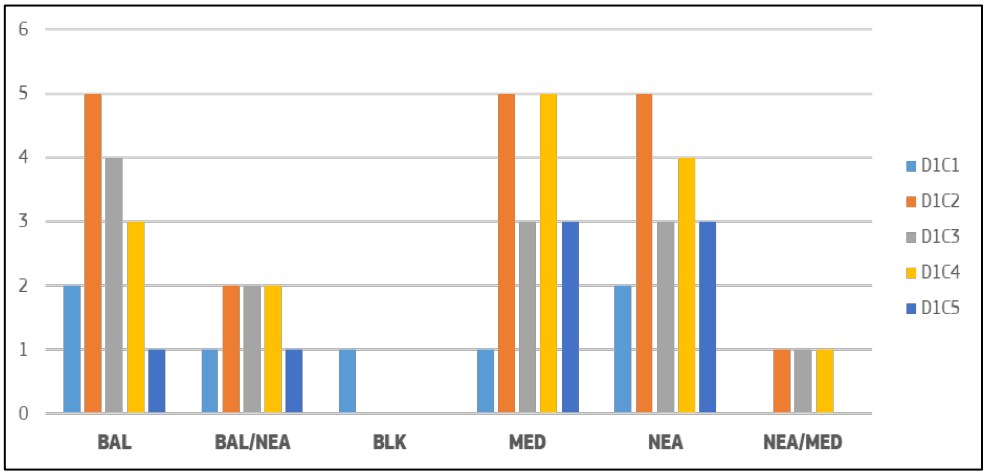


Figure 34. Number of MS reporting on D1 criteria across MS regions for marine mammals.

D1-Marine Reptiles

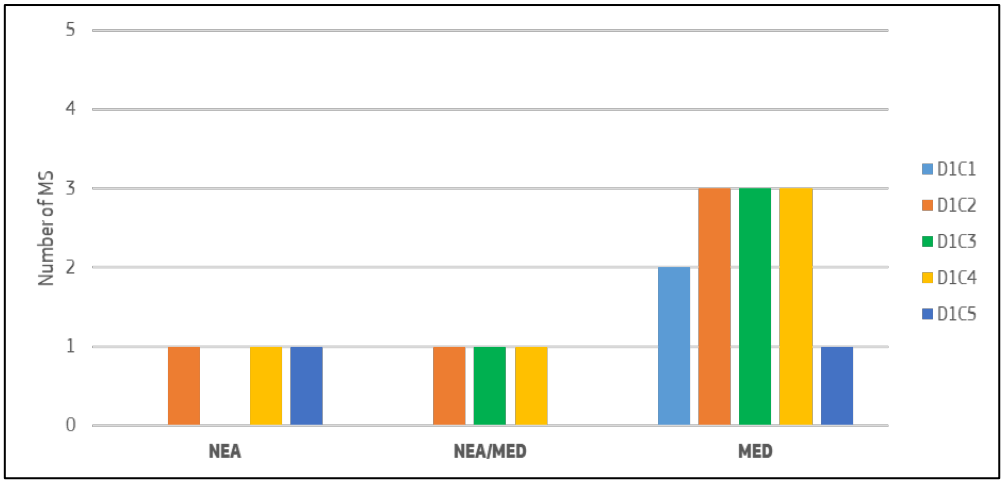


Figure 35. Number of species reported by MS per D1 criteria across MS regions for marine reptiles.

D1-Fish and Cephalopods

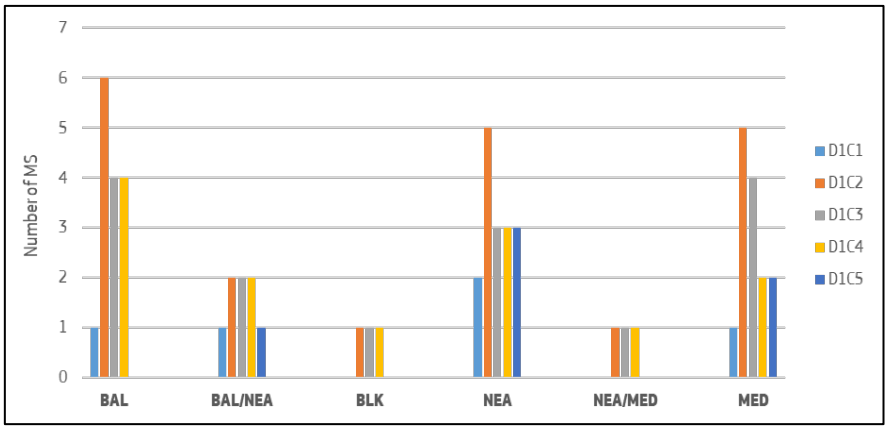


Figure 36. Number of MS reporting on D1 criteria across MS regions for fish and cephalopods.

D1-Seabirds

The primary criterion D1C2 for species abundance was adequately reported across all regions, as well as the population characteristics (D1C3) and distribution (D1C4). D1C5 (habitat for the species) is reported by less MS (DE, DK, HR, SI) compared to other criteria (Figure 37).

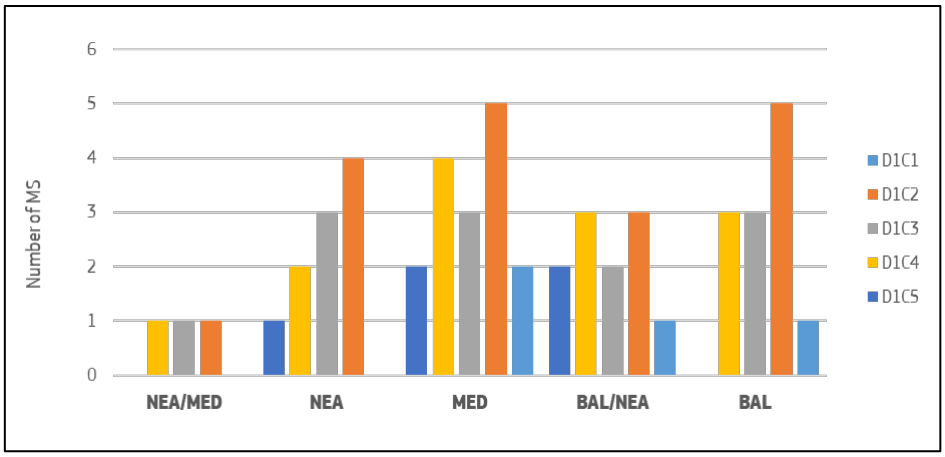


Figure 37. Number of MS reporting on D1 criteria across MS regions for seabirds.

D1-Pelagic Habitats

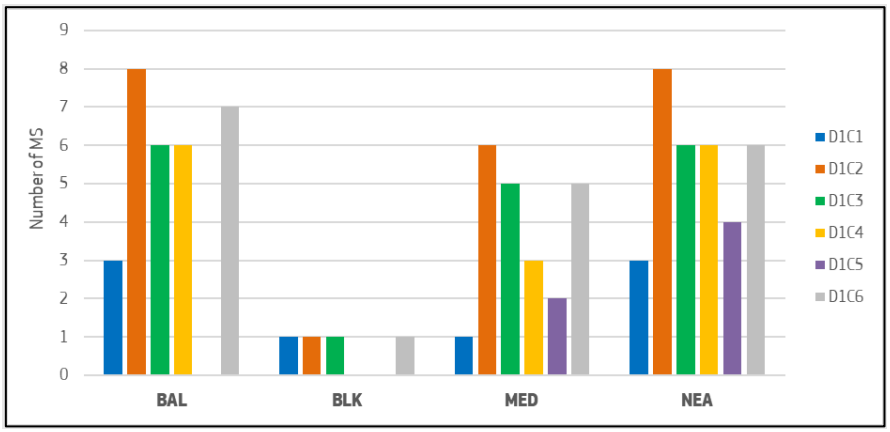


Figure 38. Number of MS reporting on D1-Pelagic Habitats and other D1 criteria across marine regions (ES, DK and SE not included).

D4

Figure 39 shows the consideration of D4 criteria within each marine region. In the Baltic region, harmonisation is higher, particular for D4C1, followed by the Mediterranean and the North East Atlantic region.

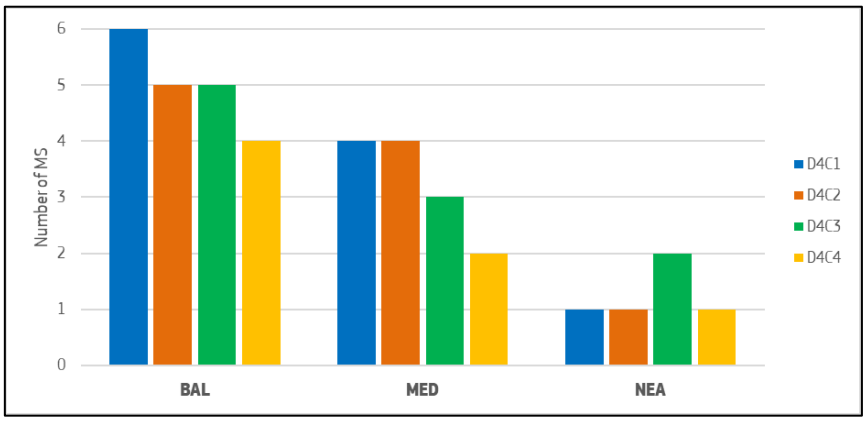


Figure 39. Number of MS reporting on D4 criteria across marine regions (ES, DK and SE not included).

D6

As shown in Figure 40, there is a good harmonisation and good coverage of the use of criteria at regional level. An exception is the BLK, but the work of the TG Seabed aims at further developing and harmonising the monitoring and assessment of the agreed criteria.

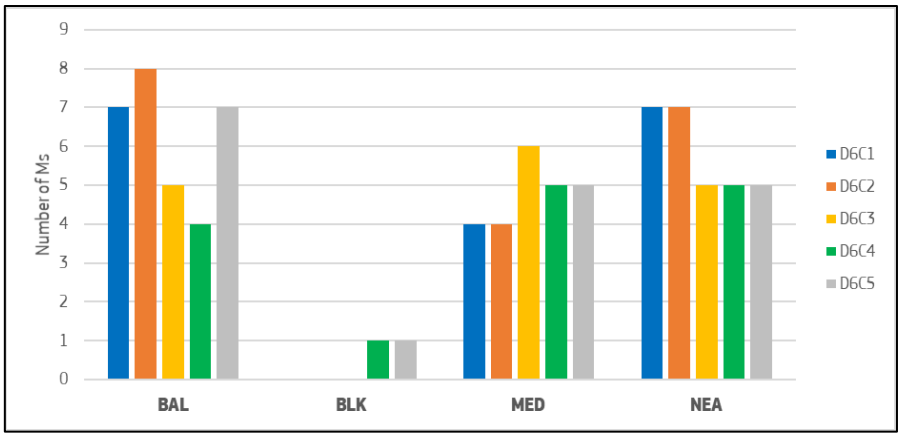


Figure 40. Number of MS reporting on D6 criteria across marine regions (ES, DK and SE not included).

4.1.3 Spatial coverage

According to the monitoring reporting guidance (MSFD Guidance Document 17), MS should report the spatial coverage of the programme according to the jurisdictional zones of marine waters. This is intended to give only a coarse categorization of the areas (zones) covered by the programme. However, the way the information is reported under the 'SpatialScope" reporting field (i.e., usually many different spatial areas in the same reporting cell) makes it difficult to really understand which elements/parameters are monitored in the different spatial areas. For this analysis and for most descriptors, the reported spatial scopes have been split into the different categories in order to indicate the number of MS that have monitoring in place in each area.

D2

Small differences (i.e., 1 or 2 MS) in the spatial areas can be observed for D2C1 and D2C2. Monitoring programmes for these criteria cover especially coastal waters (Figure 41).

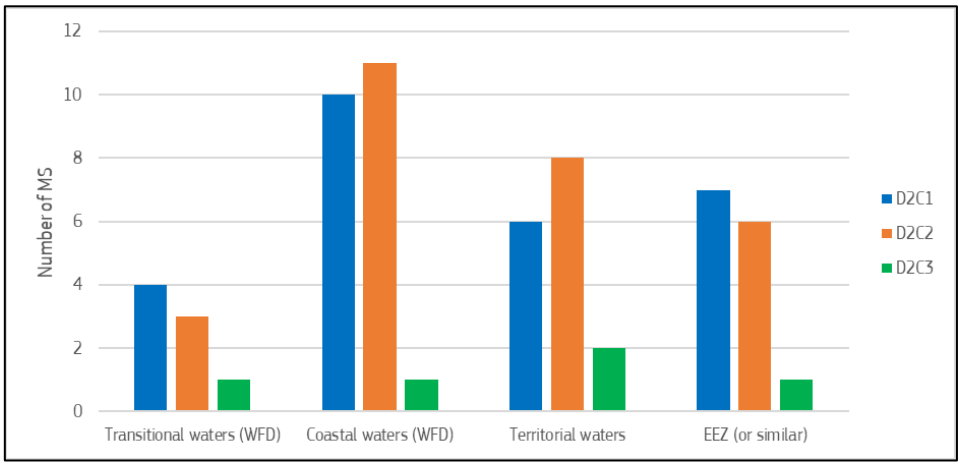


Figure 41. Spatial scope indicated by MS for D2 criteria monitoring.

D3

All 18 MS have reported for the marine 'SubRegions' relevant to their territorial waters. Despite the difficulty of assigning the monitoring of particular elements/parameters to a specific spatial area, it is clear that most monitoring is carried out in territorial waters/EEZ (Figure 42).

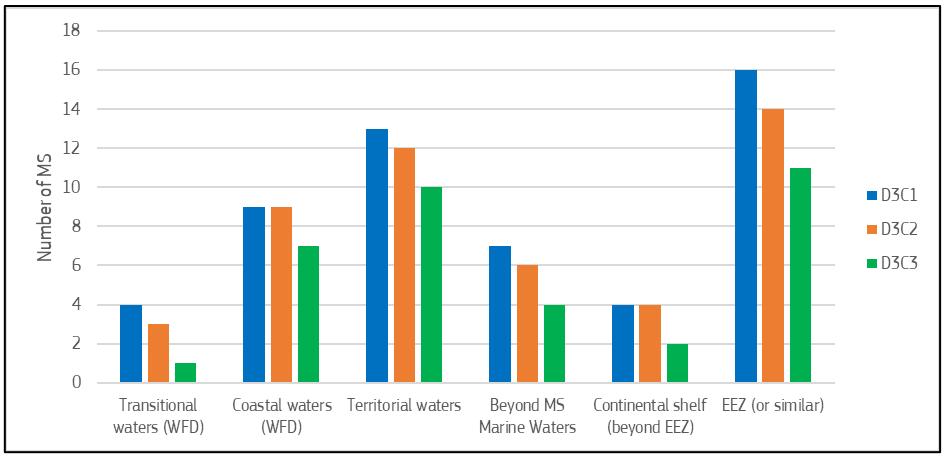


Figure 42. Spatial scope indicated by MS for D3 criteria monitoring.

D5

Most of D5 monitoring programmes cover the 'Coastal waters (WFD)' with a minimum number of MS (5 MS: DK, NL, IE, LT, SE, SI) for D5C8 and a maximum number (14 MS: BE, CY, DE, EE, ES, FR, HR, IE, IT, LT, LV, NL, SE, SI) for D5C2. The 'EEZ (or similar)' spatial scope was indicated by 12 MS (BE, CY, DE, DK, EE, ES, FI, IE, LT, LV, NL, SE) for D5C2 and D5C5, whereas only by 1 MS (PL) for D5C6 and D5C7. 12 MS (BE, CY, EE, ES, FR, HR, IT, LT, LV, RO, SE, SI) reported 'Territorial waters' for D5C2 and no MS considered this spatial scope for D5C6.

'Transitional waters (WFD)' is considered for all the D5 criteria, but by few MS (DE, IT, LV, IE, HR). Less monitoring is in place for 'Beyond MS Marine waters', the 'Continental shelf (beyond EEZ)' and the 'Terrestrial part of MS'.

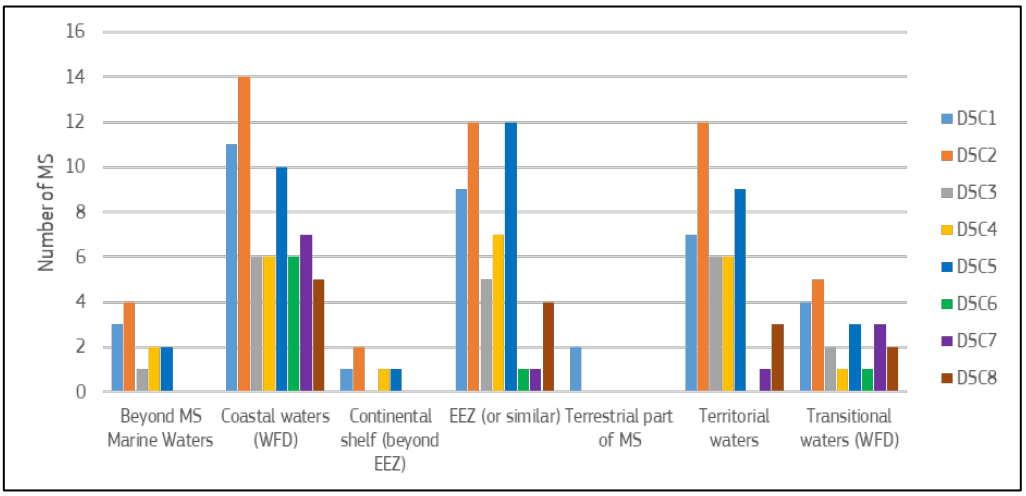


Figure 43. Spatial scope indicated by MS for D5 criteria monitoring.

D7

D7 monitoring is mostly focused on coastal waters, territorial waters and EEZ (or similar) for the features, elements, and/or parameters that are listed under both D7C1 and D7C2. Some slight differences can be appreciated in Figure 44, considering that a number of MS are monitoring different parameters at different spatial coverages. For instance, DE foresees monitoring S and T, and EE bathymetry and seabed morphology only in coastal waters in some of their MRUs. Likewise, SE indicates different spatial scopes for different MRUs and monitors some elements only in some MRUs).

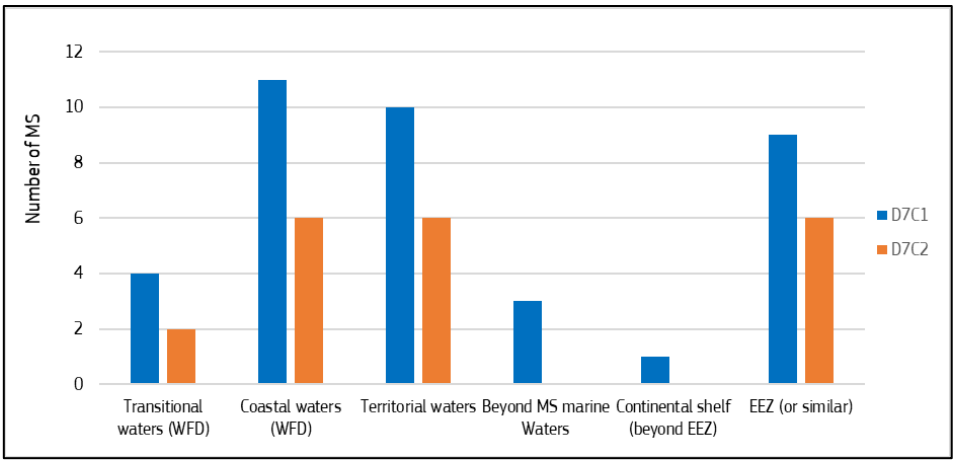


Figure 44. Spatial scope indicated by MS for D7 criteria monitoring.

D8

Figure 45 shows the spatial scope used by MS for the different D8 criteria. Despite the difficulty of assigning the monitoring of particular elements/parameters to a specific spatial area, it seems clear that D8C1 monitoring is mostly performed in coastal/territorial waters and also 14 MS (BE, CY, DE, DK, EE, ES, FI, FR, IE, IT, LT, NL, PL, SE) have monitoring in place beyond MS marine waters and/or in the EEZ area. D8C2 monitoring is mostly performed in coastal areas and the monitoring of acute pollution events (D8C3) in both coastal areas and the EEZ area.

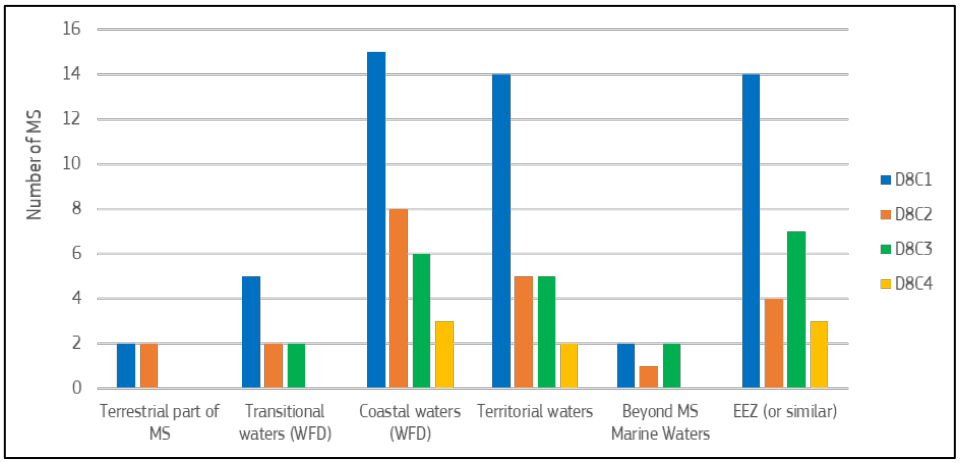


Figure 45. Spatial scope indicated by MS for D8 criteria monitoring.

D9

Figure 46 shows the spatial scope used by MS for D9C1. Although it is not possible to understand which elements/parameters are monitored in the different spatial areas, it can be seen that D9C1 monitoring is mostly performed in the EEZ area (12 MS: BE, CY, DK, EE, ES, FI, FR, IE, LT, NL, PL, SE) and territorial waters (10 MS: CY, EE, ES, HR, IT, LT, LV, RO, SE, SI). Coastal waters is only reported by 6 MS (CY, FR, IE, LT, SE, SI).

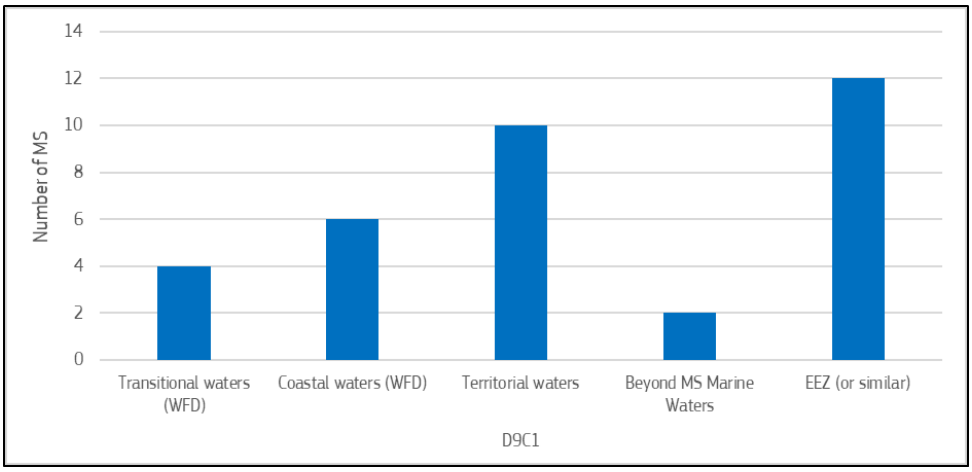


Figure 46. Spatial scope indicated by MS for D9 monitoring

D10

Monitoring programmes are mainly performed in terrestrial waters, coastal waters, EEZ (or similar), and the terrestrial part of MS (Figure 47). The wide spatial distribution of monitoring programmes is mainly due to the defined environmental compartments for D10, particularly for the primary criteria (i.e., D10C1 and D10C2 have defined environmental compartments under the GES Decision: coastline, surface layer of the water column, and seabed). Consequently, some MS (DE, DK, ES, FR, IE, IT, NL, PL, SE) reported similar programmes within each primary criteria for each environmental compartment and/or MRU.

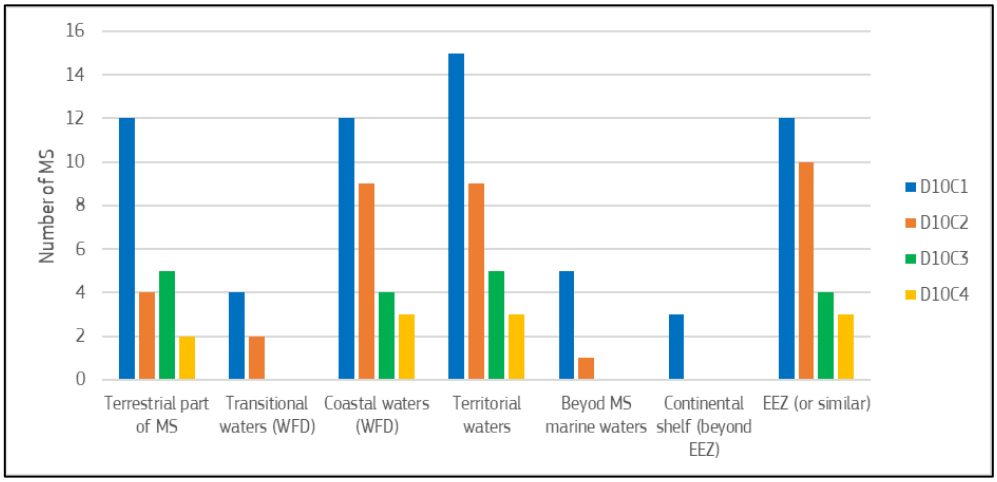


Figure 47. Spatial scope indicated by MS for D10 criteria monitoring.

D11

Figure 48 shows the spatial coverage used by MS for D11. Monitoring by most MS consistently focuses on the coastal and territorial waters and EEZ (or similar), although with some slight differences. Indeed, LV and BE have coastal water monitoring only for D11C1, while waters beyond MS marine waters are considered by NL only for D11C1, and by SE only for D11C2. LV also considers EEZ only for D11C2. Finally, ES considers also transitional and terrestrial waters monitoring for the features, elements and/or parameters that are listed under 'not relevant' or null for D11 criteria (not showed in the figure).

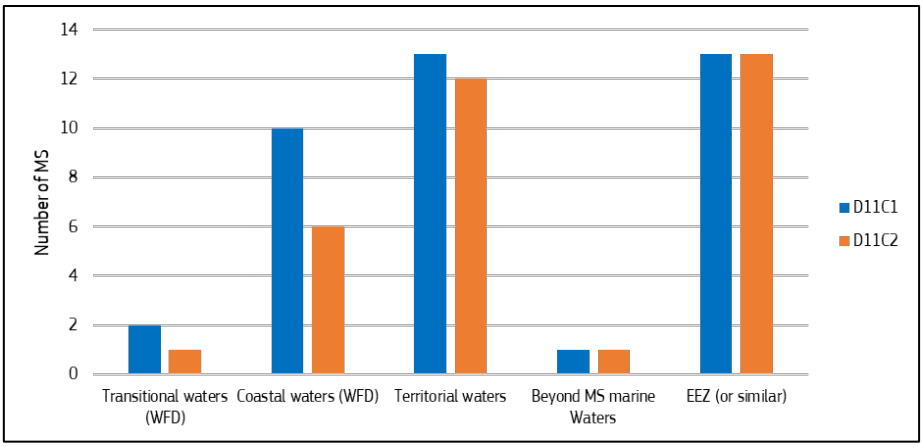


Figure 48. Spatial scope indicated by MS for D11 criteria monitoring.

D1-Marine Mammals

The marine mammal's spatial distribution goes beyond the marine jurisdiction of most of the MS and as such the only relevant spatial scope should be in line with the GES Decision[10].

For seals, the terrestrial part of MS is relevant as the monitoring and assessment of the nested areas are essential information for the species assessments. The reported information does not provide an accurate representation of the spatial scope of the monitoring to the diverse distribution across species of the same group.

Table 11. Spatial scopes reported for marine mammal's monitoring.

Spatial Scope	Baleen Whales	Deep Diving	Small toothed	Seals
Beyond MS Marine Waters	+	+	+	+
Coastal waters (WFD)	+	+	+	+
Continental shelf (beyond EEZ)	+	+	+	
EEZ (or similar)		+	+	+
Terrestrial part of MS		+	+	+
Territorial waters			+	+
Transitional waters (WFD)			+	+

D1-Marine Reptiles

Turtles are mostly monitored in coastal waters and the EEZ. Less frequently, turtles were reported to be monitored beyond MS marine waters, the terrestrial part of MS and territorial waters (Table 12).

Table 12. Spatial scopes reported for marine reptile's monitoring.

Spatial Scope	*Caretta caretta*	*Chelonia mydas*	*Dermochelys coriacea*	*Eretmochelys imbricata*	*Lepidochelys kempii*	*Lepidochelys olivacea*	Total
Beyond MS Marine Waters, EEZ (or similar), Territorial waters	+						1
Coastal waters (WFD)	+	+	+	+	+	+	6

([10]) "Scale of assessment: Ecologically-relevant scales for each species group shall be used, as follows:
for deep-diving toothed cetaceans, baleen whales: region,
for small toothed cetaceans: region or subdivisions for Baltic Sea and Black Sea; subregion for North-East Atlantic Ocean and Mediterranean Sea,
for seals: region or subdivisions for Baltic Sea; subregion for North-East Atlantic Ocean and Mediterranean Sea"

Coastal waters (WFD), EEZ (or similar), Terrestrial part of MS, Territorial waters, Transitional waters (WFD)	+	+					2
Coastal waters (WFD), EEZ (or similar), Territorial waters	+	+	+				3
EEZ (or similar), Territorial waters	+		+				2
Terrestrial part of MS	+						1
Territorial waters	+						1

D1-Fish and Cephalopods

The fish and cephalopods spatial distribution goes beyond the marine jurisdiction of most of the MS. The monitoring of the majority of demersal fish is reported at EEZ and beyond MS waters, while the majority of coastal fish at transitional and coastal waters. The deep sea and pelagic fish are monitored at EEZ and the coastal and deep-sea cephalopods, at EEZ and territorial waters (Table 13).

Table 13. Spatial scopes reported for fish and cephalopod's monitoring.

Spatial Scope	Cepha Coast Shelf	Cepha Deep Sea	Fish Coastal	Fish Deep Sea	Fish Demersal Shelf	Fish Pelagic Shelf
Beyond MS Marine Waters			+	+	+	+
Beyond MS Marine Waters, Coastal waters (WFD), EEZ (or similar), Territorial waters	+	+	+		+	+
Beyond MS Marine Waters, EEZ (or similar), Territorial waters			+		+	+
Coastal waters (WFD)			+		+	+
Coastal waters (WFD), EEZ (or similar), Terrestrial part of MS, Territorial waters	+	+	+	+	+	+
Coastal waters (WFD), EEZ (or similar), Territorial waters	+	+	+	+	+	+
Coastal waters (WFD), Territorial waters	+		+		+	+
Coastal waters (WFD), Territorial waters, Transitional waters (WFD)			+		+	+
EEZ (or similar)				+	+	+
EEZ (or similar), Territorial waters	+	+	+	+	+	+
Territorial waters			+		+	+
Transitional waters (WFD)			+		+	+

D1-Seabirds

The vast majority of seabirds have monitoring programmes in the coastal zone, as it was expected. Most monitoring programmes for benthic feeding birds were reported to cover coastal waters, EEZs, and territorial waters. Many of the monitoring programmes for grazing birds were reported to cover the exclusive economic zones of MS. For pelagic feeding birds, monitoring is most frequent in coastal waters (WFD), EEZ and territorial waters. The monitoring programmes for most of the surface feeding birds were reported to cover the terrestrial part of MS and for wading birds in the EEZ and the terrestrial part of MS

Table 14. Spatial scopes reported for fish and cephalopod's monitoring.

Spatial Scope	BirdsBenthicFeeding	BirdsGrazing	BirdsPelagicFeeding	BirdsSurfaceFeeding	BirdsWading
Beyond MS Marine Waters,Coastal waters (WFD),EEZ (or similar),Terrestrial part of MS,Territorial waters	+		+	+	
Beyond MS Marine Waters,Continental shelf (beyond EEZ),EEZ (or similar),Territorial waters			+	+	
Coastal waters (WFD)	+	+	+	+	+
Coastal waters (WFD),Continental shelf (beyond EEZ),EEZ (or similar),Terrestrial part of MS,Transitional waters (WFD)	+	+	+	+	+
Coastal waters (WFD),EEZ (or similar),Terrestrial part of MS,Territorial waters	+		+	+	
Coastal waters (WFD),EEZ (or similar),Terrestrial part of MS,Territorial waters,Transitional waters (WFD)	+	+	+	+	+
Coastal waters (WFD),EEZ (or similar),Territorial waters	+	+	+	+	+
Coastal waters (WFD),EEZ (or similar),Territorial waters,Transitional waters (WFD)	+	+	+	+	+
Coastal waters (WFD),Terrestrial part of MS			+	+	+
Coastal waters (WFD),Terrestrial part of MS,Territorial waters	+	+	+	+	
Coastal waters (WFD),Territorial waters	+	+	+	+	+
Coastal waters (WFD),Territorial waters,Transitional waters (WFD)	+	+	+	+	+
Coastal waters (WFD),Transitional waters (WFD)		+			+
EEZ (or similar)	+	+	+	+	+
EEZ (or similar),Terrestrial part of MS			+	+	
Terrestrial part of MS	+	+	+	+	+
Terrestrial part of MS,Transitional waters (WFD)			+	+	+
Territorial waters	+	+	+	+	+

D1-Pelagic Habitats

The majority of MS (11 MS: BE, EE, ES, FR, HR, IT, LT, LV, NL, SE, SI) carry out monitoring programmes in territorial waters, the EEZ (BE, DE, EE, ES, FR, LT, LV, NL, PL, SE) and coastal waters (BE, DE, EE, ES, FR, IT, LT, LV, SE, SI). Less represented spatial areas are the transitional waters (DE, LT, LV), the continental shelf (beyond EEZ) (FR)

and beyond MS marine waters (FR, SE) (Figure 49).

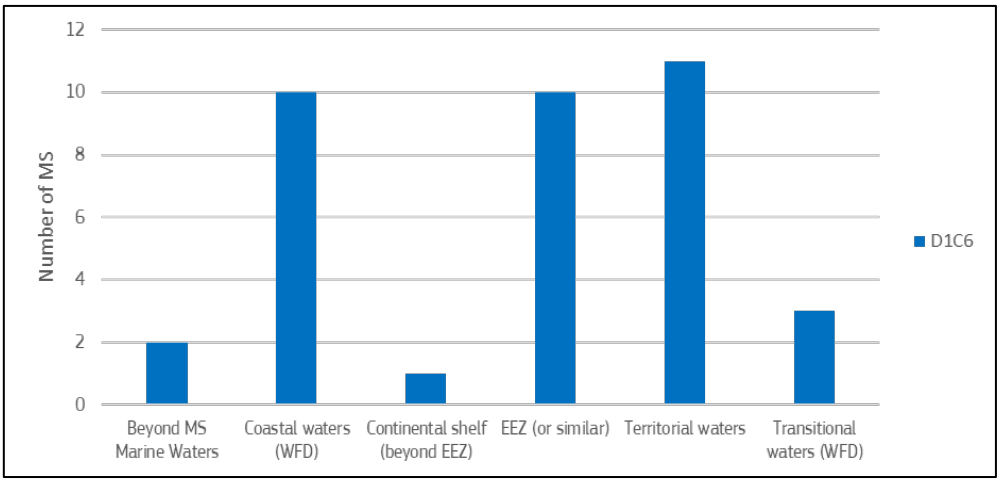


Figure 49. Spatial scope indicated by MS for D1C6 monitoring.

The indicated spatial scopes cover the pelagic broad habitat types. 3 MS (BE, DE, FR) misreported the elements 'Phytoplankton communities' and 'Zooplankton communities' and used them under the feature 'HabPelBHT' instead of 'HabPelOTH'. The most monitored element of the 'HabPelBHT' feature is 'Coastal pelagic habitat'. 6 MS reported on it in territorial waters (EE, LT, LV, RO, SE, SI), coastal waters (EE, ES, LT, LV, SE, SI) and EEZ (or similar) (EE, FI, LT, LV, SE). 1 MS (SE) reported 'Coastal pelagic habitat' beyond MS Marine waters and 2 MS (LT, LV) in transitional waters. The element 'Variable salinity pelagic habitat' is reported by SE beyond marine waters, in coastal areas by LT and SE, and in the EEZ" by ES, LT and SE. The 'Oceanic beyond shelf pelagic habitat' is monitored by ES in the continental shelf and territorial waters (Table 15).

Table 15. Number of MS reporting monitoring programmes covering broad habitat types (HabPelBHT) at different spatial scopes. In grey colour the elements used by MS in place of HabPelBHT.

Feature HabPelBHT	Coastal pelagic habitat	Diatoms & Dinoflagellates	Oceanic/beyond shelf pelagic habitat	Phytoplankton communities	Shelf pelagic habitat	Variable salinity pelagic habitat	Zooplankton communities
Beyond MS Marine Waters	1	0	0	1	1	1	1
Coastal waters (WFD)	6	1	0	3	2	2	3
Continental shelf (beyond EEZ)	0	0	0	1	0	0	1
EEZ (or similar)	8	1	1	1	4	3	2
Territorial waters	6	0	1	2	4	5	2
Transitional waters (WFD)	2	0	0	1	1	1	1

'Zooplankton communities' is the most reported element (15 MS) under the feature 'HabPelOTH' and within coastal waters (Table 16).

Table 16: Number of MS reporting monitoring programmes covering Other Pelagic habitat (HabPelOTH) at different spatial scopes.

HabPelOTH	Phytoplankton communities	Zooplankton communities	Zooplankton communities - gelatinous
Coastal waters (WFD)	2	3	1
EEZ (or similar)	3	4	1
Territorial waters	3	4	1

D4

Despite the difficulty of assigning the monitoring of particular elements/parameters to a specific spatial area,

it seems clear that most monitoring is performed in territorial waters (7 MS: EE, HR, IT, LT, PL, SE, SI), EEZ (7MS: DK, EE, ES, FI, LT, PL, SE) and coastal waters (6 MS; EE, FI, IT, LT, SE, SI), while only 2 MS (LT, PL) have also monitoring in transitional waters, 3 MS (IT, NL, SE) beyond MS Marine Waters and 1 MS (SE) in the terrestrial part of MS.

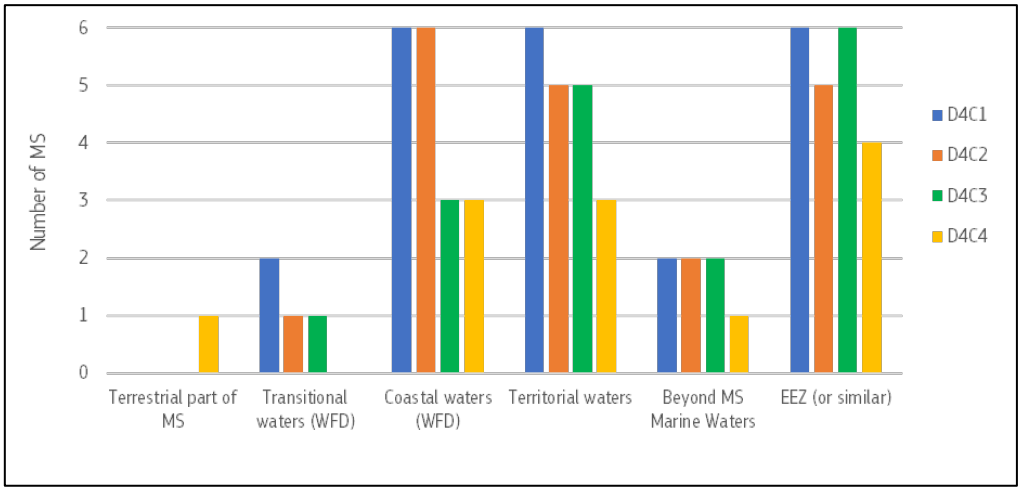


Figure 50. Spatial scope indicated by MS for D4 criteria monitoring.

D6

Monitoring is more frequent in coastal waters and the EEZ. However, the default spatial delineation is not self-explanatory for the MS that reported in a non-consistent way on the spatial scope of the monitoring.

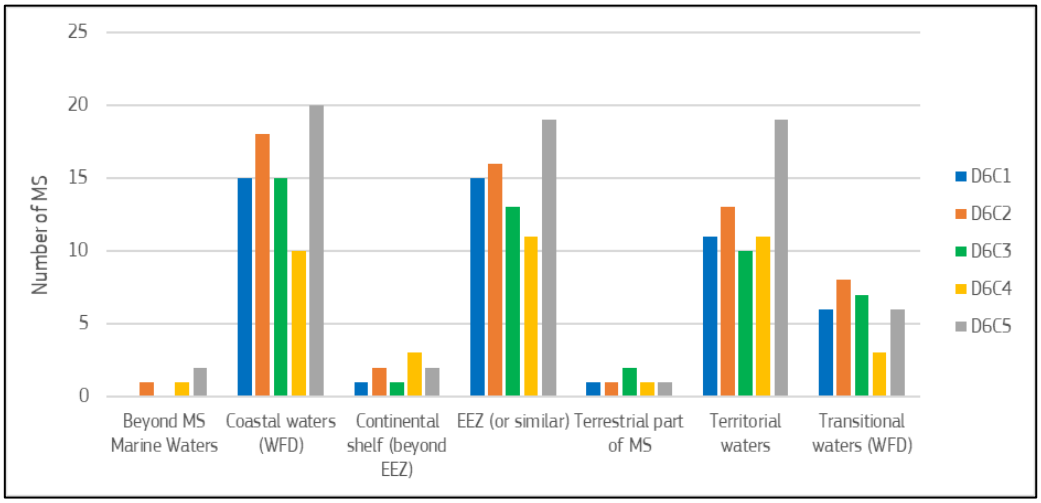


Figure 51. Spatial scope indicated by MS for D6 criteria monitoring.

4.1.3.1 Coherence in the spatial coverage across MS in the marine region

D2

With the exception of the Black Sea, where the spatial coverage for all criteria is 'Territorial waters', monitoring occurs in the Baltic, North- East Atlantic and Mediterranean Sea across all the spatial areas (Table 17).

Table 17. Spatial scope per D2 criteria and marine region (ES, DK and SE not included).

		Coastal waters (WFD)	EEZ (or similar)	Territorial waters	Transitional waters (WFD)
BAL	D2C1	3	1	3	
	D2C2	4	3	2	2

	D2C3	1	1	1	1
	D2C1			1	
	D2C2			1	
BLK	D2C3			1	
	D2C1	2		1	
	D2C2	4		2	
MED	D2C3				
	D2C1	3	3	1	1
	D2C2	1			
NEA	D2C3				

D3

MS reported up to three different entries by region under 'SpatialScope' (Table 18). In the BAL and BLK regions, the majority of spatial scopes concerned territorial waters/EEZ, while in the MED and NEA there was a greater diversity of spatial scopes (Table 18). The majority of commercial stocks would require monitoring beyond individual EEZ/territorial waters, but if MS data are pooled across the region for the purpose of stock assessment this is not a problem. Therefore, the 'SpatialScope' reporting field is not particularly informative for D3.

Table 18. Spatial scope per D3 criteria and marine region (ES, DK and SE not included).

	BAL			**BLK**			**MED**			**NEA**		
	D3C1	**D3C2**	**D3C3**	**D3C1**	**D3C2**	**D3C3**	**D3C1**	**D3C2**	**D3C3**	**D3C1**	**D3C2**	**D3C3**
Transitional waters (WFD)	-	-	-	-	-	-	1	-	-	3	2	1
Coastal waters (WFD)	2	2	2	-	-	-	3	3	3	4	4	2
Territorial waters	5	4	4	-	-	-	5	5	4	4	4	2
Beyond MS Marine Waters	2	1	1	-	-	-	2	2	1	4	4	2
Continental shelf (beyond EEZ)	-	-	-	-	-	-	1	1	-	3	3	1
EEZ (or similar)	6	5	5	1	1	1	3	3	2	5	4	2

D5

Table 19. Spatial scope per D5 criteria and marine region (ES, DK and SE not included).

	Spatial scopes	**Beyond MS Marine Waters**	**Coastal waters (WFD)**	**Continental shelf (beyond EEZ)**	**EEZ (or similar)**	**Terrestrial part of MS**	**Territorial waters**	**Transitional waters (WFD)**
BAL	D5C1	1	4		3	1	2	3
	D5C2	4	8	1	5		3	3
	D5C3		3		3		2	2
	D5C4		2		3		1	
	D5C5		3		5	2	3	1
	D5C6		1		1			
	D5C7		3		1		1	2
	D5C8		2		3		2	1
BLK	D5C1				1			
	D5C2		8				1	
	D5C3				3		1	
	D5C4		2				1	
	D5C5				1	1	1	
	D5C6		1					
	D5C7							

	Spatial scopes	Beyond MS Marine Waters	Coastal waters (WFD)	Continental shelf (beyond EEZ)	EEZ (or similar)	Terrestrial part of MS	Territorial waters	Transitional waters (WFD)
	D5C8							
MED	D5C1	1	4	1			2	1
	D5C2	5	7	1	1		5	1
	D5C3		1				1	
	D5C4	1	2	1	1		2	1
	D5C5	1	4	1	1	4	5	1
	D5C6		2					
	D5C7		2					
	D5C8		1					
NEA	D5C1	2	3	1	3	2	2	1
	D5C2	5	9	1	4		5	2
	D5C3		1		1		2	1
	D5C4	1	2	1	1		1	
	D5C5	1	3	1	3	1	3	1
	D5C6		2					1
	D5C7		2					1
	D5C8		1					1

Table 20. Number of elements reported for D5 per spatial scope and marine region (ES, DK and SE not included).

Spatial scope	BAL	BLK	MED	NEA
Beyond MS Marine Waters	4	0	62	52
Coastal waters (WFD)	183	1	179	58
Continental shelf (beyond EEZ)	5	0	104	0
EEZ (or similar)	211	3	9	25
Terrestrial part of MS	9	0	47	17
Territorial waters	149	8	182	4
Transitional waters (WFD)	84	0	80	15

D7

The spatial scopes for monitoring D7 criteria across marine regions are shown in Table 21. Within all marine regions, D7 monitoring is concentrated in coastal waters (WFD), EEZ (or similar), and territorial waters. Although some specific differences exist, there is a general coherence across MS in each marine region. Only 1 MS in BAL (SE), in MED (IT) and in NEA (SE) and 1 (DE) in BAL and NEA regions indicate, respectively, monitoring D7C1 beyond MS marine waters and in the continental shelf (beyond EEZ). DK monitors both criteria in the EEZ (or similar), ES and SE do so in coastal waters, the EEZ and territorial waters, while SE also monitors some of the D7C1 features and elements beyond MS marine waters.

Table 21. Spatial scope per D7 criteria and marine region (ES, DK and SE not included).

Spatial scope	BAL		BLK		MED		NEA	
	D7C1	D7C2	D7C1	D7C2	D7C1	D7C2	D7C1	D7C2
Transitional waters (WFD)	2	1			1	1	2	1
Coastal waters (WFD)	5	2			3	2	4	1
Territorial waters	4	2		1	3	1	2	1
Beyond MS marine Waters	1				1		1	
Continental shelf (beyond EEZ)	1						1	
EEZ (or similar)	3	1				1	4	2

D8

The spatial scopes for monitoring D8 criteria across marine regions are shown in Table 22. Overall, there is coherence across MS in each marine region for D8C1 monitoring, which is concentrated in coastal waters, EEZ and territorial waters. Coherence in the spatial scope for D8C2 is also seen in the Mediterranean (concentrated in coastal waters and the EEZ) and to a lesser extent in the Baltic (concentrated in coastal waters).

Table 22. Spatial scope per D8 criteria and marine region (all 18 MS are included).

Spatial scope	BAL				BLK				MED				NEA			
	D8C1	D8C2	D8C3	D8C4	D8C1	D8C2	D8C3	D8C4	D8C1	D8C2	D8C3	D8C4	D8C1	D8C2	D8C3	D8C4
Terrestrial part of MS	2	2											1			
Transitional waters (WFD)	3	1	1						1	1			3		1	
Coastal waters (WFD)	7	4	3	2					4	2	2	1	8	5	3	2
Territorial waters	5	3	2	1	1				6	2	2	1	6	1	2	2
Beyond MS Marine Waters	1		1						1	1			1		2	
EEZ (or similar)	7	1	4	1					4	1	1	1	8	4	5	3

D9

The spatial scopes for D9 monitoring across marine regions are shown in Table 23. Overall, there is coherence across MS in each marine region: monitoring is concentrated in the EEZ area in the Atlantic and Baltic regions, while in the Mediterranean monitoring is mostly done in territorial waters.

Table 23. Spatial scope for D9 per marine region (all 18 MS are included).

Spatial scope	BAL	BLK	MED	NEA
	D9C1	D9C1	D9C1	D9C1
Transitional waters (WFD)	2		2	2
Coastal waters (WFD)	2		3	3
Territorial waters	4	1	5	2
Beyond MS Marine Waters			1	1
EEZ (or similar)	6		3	6

D10

The spatial scopes of monitoring indicated by MS under D10 criteria across marine regions are shown in Table 24. The monitoring of the D10 criteria within all marine regions shows the same pattern as described in the previous section, where monitoring is concentrated in terrestrial waters, coastal waters, EEZ, and the terrestrial part. However, there is a higher spatial coverage of beyond MS marine waters and EEZ in the BAL (DE, DK, EE, FI, LT, LV, PL, SE) and NEA (BE, DE, DK, ES, FR, IE, NL, SE) regions.

Generally, in the spatial categories where MS reported monitoring programmes for D10C1, some MS in the BAL, MED and NEA regions also considered D10C2. Secondary criteria, D10C3 and D10C4, were mainly considered in the MED and NEA regions, although monitoring programmes in the BAL region were also indicated for the EEZ (DE, DK, EE).

The number of elements reported for each D10 criteria for each spatial scope within the different and marine regions is shown in Table 25. The number of elements reported is highly variable within each region and each criterion, ranging from 1 to 130. The variability depends on the number of elements considered by each MS for each environmental compartment and MRU in each monitoring programme reported. For instance, IT reported for the territorial waters in the MED region for D10C1 a total of 9 elements for each environmental compartment 'surface layer of the water column' and 'seabed' in three different MRU.

Table 24. Spatial scope per D10 criteria and marine region (all 18 MS included).

Spatial scope	BAL				BLK				MED				NEA			
	D10C1	D10C2	D10C3	D10C4	D10C1	D10C2	D10C3	D10C4	D10C1	D10C2	D10C3	D10C4	D10C1	D10C2	D10C3	D10C4
Terrestrial part of MS	5	2			1				5	3	4	2	5	3	4	1
Transitional waters (WFD)	2	2							1				1			
Coastal waters (WFD)	4	5		1					4	3	4	2	5	3	2	1
Territorial waters	6	4	1	1	1				6	5	5	2	5	3	2	2
Beyond MS marine Waters	3								1	1			4			
Continental shelf (beyond EEZ)	1								1				2			
EEZ (or similar)	6	7	2	1					3	1	1	1	8	5	4	1

Table 25. Number of elements reported for D10 criteria per spatial scope and marine region (all 18 MS included).

Spatial scope	BAL				BLK				MED				NEA			
	D10C1	D10C2	D10C3	D10C4	D10C1	D10C2	D10C3	D10C4	D10C1	D10C2	D10C3	D10C4	D10C1	D10C2	D10C3	D10C4
Terrestrial part of MS	10	4			1				27	5	6	2	12	4	6	1
Transitional waters (WFD)	4	5							9				10			
Coastal waters (WFD)	24	14		2					88	14	6	2	35	12	3	1
Territorial waters	62	12	1	1	1				130	19	7	2	107	14	2	3
Beyond MS marine Waters	21								9	2			26			
Continental shelf (beyond EEZ)	8								9				18			
EEZ (or similar)	50	22	7	1					42	2		1	95	15	7	1

D11

Within all marine regions, D11 monitoring is concentrated in coastal waters, EEZ (or similar) and territorial waters. Although some specific differences (described above) exist, there is a general coherence across MS in each marine region (Table 26). Thus, most MS in the BAL and NEA regions concentrate their monitoring across the EEZ (or similar), while in the MED and BLK regions, monitoring plans focus mainly on territorial waters. DK monitors both criteria in the EEZ, ES does so in coastal waters, EEZ and territorial waters, and SE monitors both criteria in coastal waters, territorial waters, and the EEZ, and D11C2 also beyond MS marine waters. Just another MS in the NEA region (NL) indicated also monitoring beyond MS marine waters.

Table 26. Spatial scope per D11 criteria and marine region (ES, DK and SE not included).

Spatial scope	BAL		BLK		MED		NEA	
	D11C1	D11C2	D11C1	D11C2	D11C1	D11C2	D11C1	D11C2
Transitional waters (WFD)	2	1	0	0	0	0	0	0
Coastal waters (WFD)	4	3	0	0	3	3	3	2
Territorial waters	4	3	1	1	5	5	3	3
Beyond MS marine Waters	0	0	0	0	0	0	1	0
EEZ (or similar)	5	6	0	0	2	2	5	4

D1-Pelagic Habitats

The spatial scope reported by MS vary across marine regions accordingly to the oceanographic characteristics of the MRUs (Table 27). In the Baltic Sea, MS have monitoring mostly in the EEZ for Coastal Pelagic Habitat, Shelf Pelagic Habitat, Phytoplankton communities and Zooplankton communities. In the transitional waters, monitoring is focused on 3 elements (Coastal Pelagic Habitat, Shelf Pelagic Habitat, Variable salinity pelagic habitat), in territorial waters on Coastal Pelagic Habitat, Phytoplankton communities and Zooplankton communities, and in coastal waters on Coastal Pelagic Habitat, Phytoplankton communities and Diatoms and Dinoflagellates (Table 27).

In the BLK, RO monitoring is in place within the territorial waters for the broad pelagic habitat types.

The elements “Phytoplankton communities” and “Zooplankton communities” are monitored across all the spatial scopes.

Table 27. Spatial scope for D1C6 per marine region (ES, DK and SE not included).

Spatial scope	BAL	BLK	MED	NEA
Beyond MS Marine Waters			1	2
Coastal waters (WFD)	3		3	2
Continental shelf (beyond EEZ)			1	2
EEZ (or similar)	4			2
Territorial waters	3	3	3	2
Transitional waters (WFD)	3			2

D4

The spatial scopes for D4 monitoring per marine region are shown in Table 28. Within all marine regions, and criteria, monitoring is concentrated in coastal waters, EEZ and territorial waters. Only 1 MS (SE) in BAL and 1 MS (SE) in NEA indicated monitoring in the terrestrial part of MS, while monitoring in transitional waters is only observed in the Baltic Sea.

Table 28. Spatial scope for D4 criteria per marine region (ES, DK and SE not included).

	BAL				MED				NEA			
Spatial scope	D4C1	D4C2	D4C3	D4C4	D4C1	D4C2	D4C3	D4C4	D4C1	D4C2	D4C3	D4C4
Terrestrial part of MS				1								1
Transitional waters (WFD)	2	1	2	0	0	0	0	0	0	0	0	0

Coastal waters (WFD)	7	7	5	4	2	2	1	0	3	3	3	2
Territorial waters	5	5	5	2	3	3	2	1	2	3	3	1
Beyond MS Marine Waters	1	2	2	1	1	1	0	0	1	2	3	1
EEZ (or similar)	6	6	7	3	1	1	1	1	4	5	5	3

The number of elements reported (Table 29) is higher in coastal and territorial waters, having the highest values particularly in the MED followed by the BAL.

Table 29. Number of elements reported for D4 criteria per spatial scope and marine region (ES, DK and SE not included).

Spatial scope	**BAL**	**MED**	**NEA**
Transitional waters (WFD)	6	0	
Coastal waters (WFD)	9	111	
Territorial waters	19	127	
Beyond MS Marine Waters	0	108	2
EEZ (or similar)	27	0	

D6

Table 30. Spatial scope for D6 criteria per marine region (ES, DK and SE not included).

	Spatial Scope	**D6C1**	**D6C2**	**D6C3**	**D6C4**	**D6C5**
BAL	Beyond MS Marine Waters	0	0	0	0	0
	Coastal waters (WFD)	4	5	3	2	0
	Continental shelf (beyond EEZ)	0	0	0	0	0
	EEZ (or similar)	6	6	3	3	0
	Terrestrial part of MS	0	0	0	0	0
	Beyond MS Marine Waters	0	0	0	0	0
BLK	Coastal waters (WFD)	0	0	0	0	0
	Continental shelf (beyond EEZ)	0	0	0	0	0
	EEZ (or similar)	0	0	0	0	0
	Terrestrial part of MS	0	0	0	0	0
	Territorial waters	0	0	0	1	1
	Transitional waters (WFD)	0	0	0	0	0
	Beyond MS Marine Waters	0	0	0	0	0
MED	Coastal waters (WFD)	4	4	6	5	5
	Continental shelf (beyond EEZ)	1	1	1	1	1
	EEZ (or similar)	3	3	4	3	3
	Terrestrial part of MS	1	1	2	1	1
	Territorial waters	3	3	5	5	5
	Transitional waters (WFD)	1	2	3	2	2
	Beyond MS Marine Waters	0	1	0	1	1
NEA	Coastal waters (WFD)	5	6	4	3	4
	Continental shelf (beyond EEZ)	0	1	0	1	0
	EEZ (or similar)	8	8	5	4	6
	Terrestrial part of MS	1	1	1	0	0
	Territorial waters	4	5	2	2	4
	Transitional waters (WFD)	2	6	2	2	2

4.1.4 Temporal coverage

According to the monitoring reporting guidance (MSFD Guidance Document 17), MS should report the temporal scope of the monitoring programme (start and end date of the programme, where the start date should be the earliest date that the programme started and 9999 should be entered when there is no planned end date). Moreover, MS should also report the frequency of the monitoring. The information reported on temporal coverage is compiled here to provide a description of when monitoring occurs for the different descriptors.

D2

The temporal scope of D2 monitoring programmes ranged from 1960 to 2021, with seven temporal ranges starting after the reporting cycle 2012-2017 (Table 31).

Table 31. Temporal scope reported for D2 monitoring.

Temporal scope	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI	Total
1960-9999							+												**1**
1964-9999							+												**1**
1966-9999																+			**1**
1968-9999																	+		**1**
1975-9999					+														**1**
1979-9999	+						+												**2**
1980-9999												+							**1**
1985-9999	+																		**1**
1985-2014			+																**1**
1989-9999				+															**1**
1991-9999					+														**1**
1992-9999					+														**1**
1993-9999							+												**1**
1995-9999					+														**1**
1999-9999															+				**1**
2000-9999																	+		**1**
2002-9999						+													**1**
2005-9999	+																		**1**
2009-9999			+																**1**
2010-9999					+														**1**
2011-9999															+				**1**
2014-9999														+				+	**2**
2015-9999	+					+													**2**
2016-9999		+																	**1**
2017-2018			+																**1**
2017-2021			+																**1**
2018-9999										+									**1**
2019-9999								+									+		**2**
2020-2026						+													**1**
2020-9999							+												**1**
2021-2026									+		+		+						**3**
2021-9999				+															**1**
Total	**4**	**1**	**4**	**2**	**5**	**3**	**5**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**3**	**1**	**38**

The monitoring frequencies for D2C1 spanned from 'continually' (BE, FI) to '6-yearly' (ES). ES indicated 'unknown' while 'other' is indicated by LT, LV, NL, PL and SE, and 'as needed' by DE, HR, SE and SI. DK and ES reported '2-yearly', while DK, IE and RO also reported 6-monlthy, and BE, DE, EE, ES, FI, FI, and FR yearly (Figure 52).

For D2C2, monitoring frequencies ranged from '2-montlhy' (IT) to '6-yearly' (PL). MS also indicated 'unknown' ('ES), 'other' (CY, SE, LT) and 'as needed (SE, SI) (Figure 52).

For D2C3, RO monitoring occurs every 6 months, while for LT 'other' is indicated. For PL and EE is 'yearly', and for SI 'as needed' (Figure 52).

Figure 52. Number of MS declaring each monitoring frequency for D2 criteria.

D3

In relation to the 'TemporalScope', 30 different categories were reported, with MS reporting from one (11 MS: BE, CY, HR, IE, IT, LT, LV, NL, PL, RO, SI) to ten (DK) different categories (Table 32). The use of different temporal scope categories was quite evenly spread across MS, with no category reported by more than 3 MS. There was no particular agreement in the temporal scope between MS sharing the same subregion either. Consequently, there is a need to harmonise the temporal scope across MS and subregions.

Table 32. Temporal scope reported for D3 monitoring.

Temporal scope	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI	Total
1960-9999														+			+		**2**
1972-9999																	+		**1**
1973-9999	+																		**1**
1974-9999			+																**1**
1975-9999					+														**1**
1978-9999			+																**1**
1980-9999							+	+											**2**
1981-9999			+																**1**
1983-9999			+	+															**2**

Temporal scope	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI	Total
1987-9999			+																**1**
1988-9999				+															**1**
1991-9999			+																**1**
1992-9999			+		+														**2**
1995-9999				+														+	**2**
1999-9999			+																**1**
2000-9999																+			**1**
2002-9999			+				+												**2**
2003-9999				+															**1**
2004-9999				+															**1**
2005-9999								+				+							**2**
2007-9999				+															**1**
2008-9999				+															**1**
2009-9999						+													**1**
2010-9999										+									**1**
2011-9999				+											+		+		**3**
2016-9999		+																	**1**
2018-9999				+															**1**
2020-2022				+															**1**
2020-9999						+													**1**
2021-2026									+		+		+						**3**
Total	**1**	**1**	**9**	**10**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**3**	**1**	**41**

No particular differences were detected amongst the monitoring frequencies reported under 'MonitoringFrequency' for each of the three D3 criteria, hence a single pie chart was compiled for D3 as a whole (Figure 53). Eleven different monitoring frequencies were reported, with the one reported by most MS being 'yearly' (Figure 53). The adequacy of monitoring frequency categories 'as needed', 'other' and 'unknown' reported by 3 (ES, IT, SI), 4 (HR, LT, LV, SE) and 1 MS (IT), respectively cannot be assessed. Also, the '6-yearly' frequency reported by 1 MS (HR for D3C3) is too infrequent.

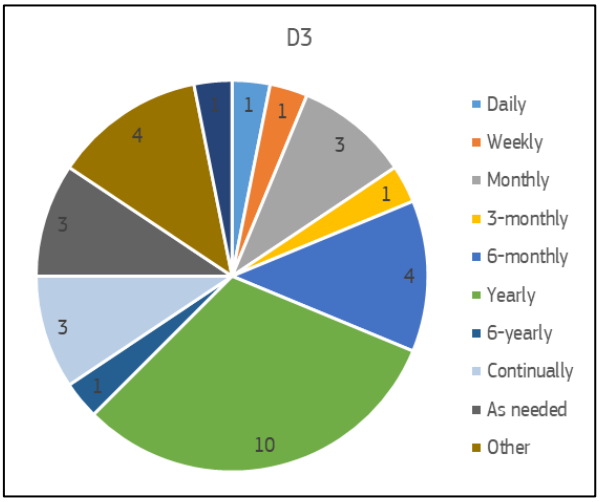


Figure 53. Number of MS declaring each monitoring frequency for D3.

D5

49 temporal scope categories were reported by 18 MS. LV reported an inconsistent temporal category ('9999-

9999'). DE reported 14 temporal categories, ranging from 1901 to 2016. SE reported the oldest monitoring programme (started in 1893). 6 MS (ES, FR, HR, IT, LV, SE) reported temporal categories starting after the reporting cycle 2012-2017 (Table 33).

Table 33. Temporal scope reported for D5 monitoring.

Temporal scope	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI	Total
1893-9999																	+		**1**
1901-9999			+																**1**
1924-9999					+														**1**
1959-9999																+			**1**
1961-9999																	+		**1**
1965-9999							+										+		**2**
1967-9999																	+		**1**
1968-9999			+																**1**
1970-9999			+				+												**2**
1971-9999																	+		**1**
1972-9999												+							**1**
1979-9999			+				+										+		**3**
1980-9999			+	+								+							**3**
1981-9999												+							**1**
1983-9999			+																**1**
1984-9999								+										+	**2**
1985-9999																+			**1**
1989-9999								+										+	**2**
1990-9999			+											+					**2**
1991-9999					+														**1**
1992-9999	+																		**1**
1993-9999					+												+		**2**
1994-9999			+																**1**
1995-9999					+	+						+							**3**
1997-9999			+																**1**
1998-9999			+																**1**
1999-9999															+				**1**
2000-9999			+																**1**
2002-9999								+											**1**
2003-9999																	+		**1**
2005-9999			+																**1**
2006-9999					+			+		+								+	**4**
2007-9999								+				+						+	**3**
2008-9999								+											**1**
2009-9999																+			**1**
2010-9999	+		+			+													**2**
2011-9999						+													**1**
2014-9999															+				**1**
2015-9999					+	+													**2**
2016-9999		+	+			+													**3**
2020-2026						+													**1**
2021-2026									+		+		+						**3**
2021-9999				+				+											**2**

Temporal scope	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI	Total
1893-9999																	+		**1**
2022-9999																	+		**1**
9999-9999													+						**1**
Total	**2**	**1**	**14**	**2**	**6**	**6**	**3**	**7**	**1**	**1**	**1**	**5**	**2**	**1**	**2**	**3**	**9**	**4**	

The monitoring frequencies reported by MS for D5C1 ranged from 'continually' to '6-yearly' (Figure 54). Six MS (DE, EE, FI, IE, LT, PL) reported the greatest '"yearly' sampling frequency, while, for instance, RO monitors this criterion every 6 months and CY and LT every 3 months. Other MS have monthly monitoring (DE, FR, IT, NL, SI), and DK every 2 weeks.

For D5C2, the most reported monitoring frequency is 'other' (6 MS: DE, ES, IE, IT, LV, SE), followed by 'yearly' (3 MS: IT, FR and SI).

'Other' was also often reported for D5C3 (6 MS: DE, EE, ES, HR, LV, SE), D5C4 (5 MS: DE, DK, ES, HR, SE), and D5C5 (7 MS: DE, DK, ES, IE, IT, NL, SE).

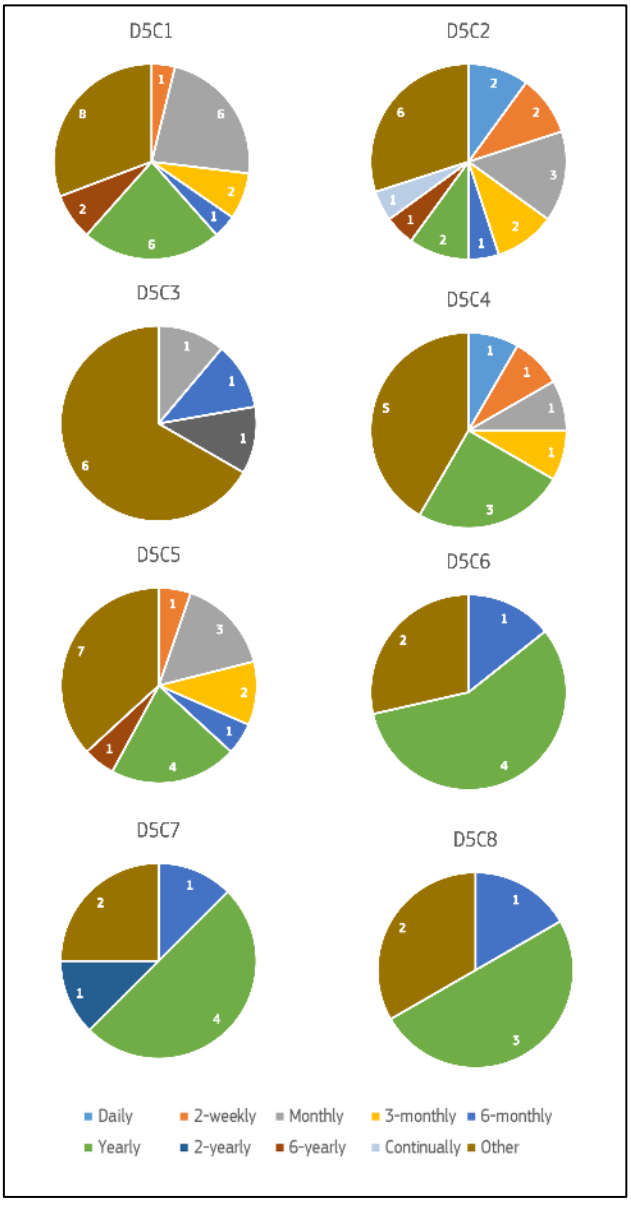


Figure 54. Number of MS declaring each monitoring frequency for D5 criteria.

D7

The temporal scope for monitoring D7 is extremely variable across MS, with even some variability within some

MS (e.g., DE, EE and SE indicate, respectively, 7, 6 and 4 different temporal ranges depending on the different elements and/or features monitored). Thus, the temporal scopes for some parameters span between the late 18th century and the last decade. In general, monitoring programmes under D7C1 are greatly variable, with starting dates ranging over more than two centuries. For D7C2, the temporal ranges are slightly less variable, but still spanning over more than 60 years (Table 34).

Table 34. Temporal scope reported for D7 monitoring.

	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI	Total
1774-9999																	+		**1**
1860-9999								+											**1**
1893-9999																	+		**1**
1901-9999			+																**1**
1958-9999																		+	**1**
1960-9999														+					**1**
1967-9999																	+		**1**
1968-9999			+														+		**2**
1970-9999			+																**1**
1972-9999												+							**1**
1980-9999			+																**1**
1981-9999					+							+							**2**
1989-9999										+									**1**
1992-9999					+			+											**2**
1993-9999					+														**1**
1994-9999					+														**1**
1997-9999				+															**1**
1998-9999			+																**1**
1999-9999															+				**1**
2000-9999			+																**1**
2006-9999										+						+			**2**
2007-9999					+														**1**
2010-9999			+																**1**
2014															+				**1**
2014-9999							+								+				**2**
2015-9999	+				+	+													**3**
2016-9999		+																	**1**
2019-9999										+									**1**
2020-9999						+													**1**
2021-9999								+											**1**
2021-2026									+		+								**2**
2022-9999																	+		**1**
9999-9999													+						**1**
Total	**1**	**1**	**7**	**1**	**6**	**2**	**1**	**3**	**1**	**3**	**1**	**2**	**1**	**1**	**3**	**1**	**5**	**1**	**41**

Regarding the sampling frequency, MS again reported variable frequencies within each criterion (Figure 55). Thus, a high variability of frequencies, spanning from 'hourly' to '6-yearly', is reported for D7C1, while for elements listed under D7C2, most MS indicated either 'yearly', 'continuous', or 'as needed'. SE and DE indicated different monitoring frequencies for some elements and parameters listed within the same criterion. Similarly, for activity- and pressure-related features, listed as 'not relevant' under the 'GEScriteria' field (and not included in the figures), the frequency of monitoring is very variable.

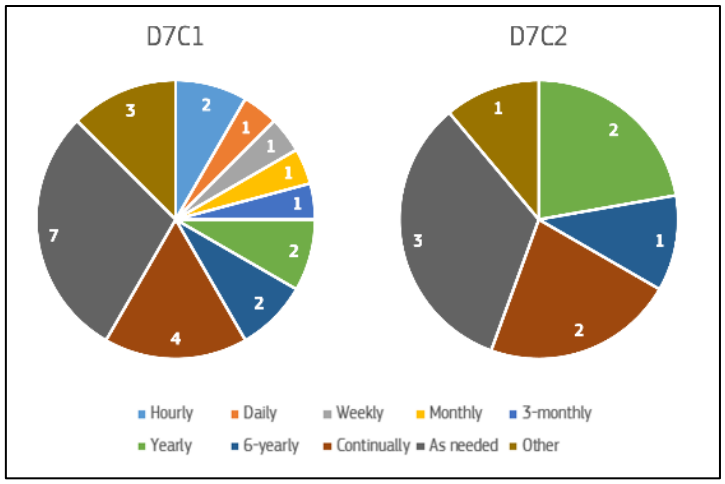


Figure 55. Number of MS declaring each monitoring frequency for D7 criteria.

D8

For D8, 43 different categories are reported, with MS reporting from one (5 MS) to eight (EE, FI) different temporal ranges. The use of different temporal scope was rather evenly spread across MS, with no category reported by more than four MS (Table 35).

Table 35. Temporal scope reported for D8 monitoring.

Temporal scope	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI	Total
1924-9999					+														1
1957-9999					+														1
1962-9999	+																		1
1965-9999																	+		1
1968-9999																	+		1
1970-9999							+												1
1974-9999							+	+											2
1975-9999							+												1
1977-9999																		+	1
1978-9999	+																		1
1979-9999							+												1
1980-9999			+																1
1983-9999			+																1
1985															+				1
1985-9999			+																1
1986-9999														+					1
1987-9999										+				+					2
1988-9999																	+		1
1989-9999																	+		1
1990-9999			+				+					+		+					4
1991-9999	+					+													2
1992-9999					+							+							2
1993-9999								+											1
1994-9999			+		+		+										+		4
1995-9999							+												1
1997-9999					+					+									2

Temporal scope	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI	Total
1998															+				**1**
1998-9999				+															**1**
1999-9999																		+	**1**
2000-9999					+			+								+			**3**
2001-9999	+																		**1**
2003-9999								+									+		**2**
2005-9999														+					**1**
2006-9999						+				+									**2**
2008-9999	+																		**1**
2010-9999					+														**1**
2012-9999							+			+									**2**
2013-9999						+													**1**
2014-9999				+	+														**2**
2015-9999															+				**1**
2016-9999		+																	**1**
2020-2022				+															**1**
2021-2026									+		+		+						**3**
Total	5	1	5	3	8	3	8	4	1	4	1	2	1	4	3	1	6	2	**62**

MS also reported variable monitoring frequencies within the criteria reported (Figure 56). Ten different monitoring frequencies have been reported; the one reported more often was 'yearly' for both D8C1 and D8C2. For D8C3, the most frequent category is 'as needed', which appears reasonable. The adequacy of the monitoring frequency category 'other', reported by 9 MS (DE, EE, ES, FI, HR, IE, LT, LV, SE) for D8C1 and 3 MS (DE, ES, HR) for D8C2, cannot be assessed.

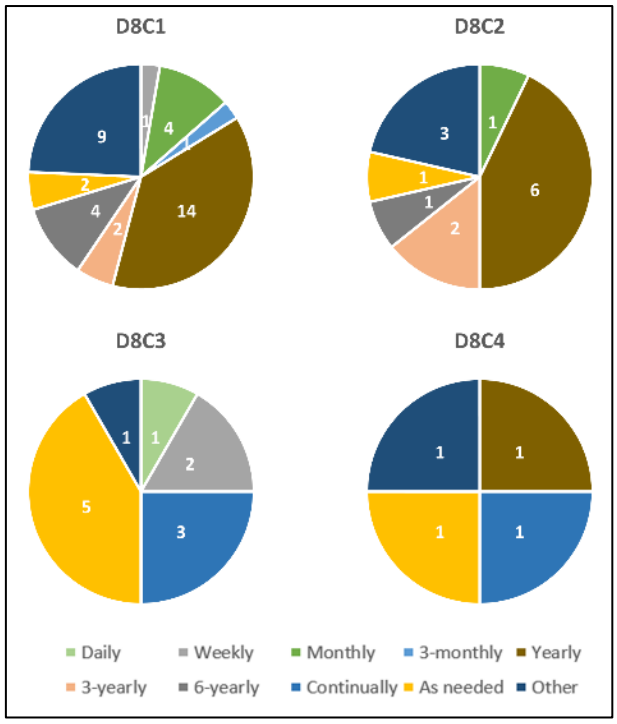


Figure 56. Number of MS declaring each monitoring frequency for D8 criteria.

D9

For D9, 15 different categories are reported, with MS reporting from one (15 MS) to two (FR, SE) temporal

ranges. The use of different temporal scope was rather evenly spread across MS, with no category reported by more than three MS (Table 36).

Table 36. Temporal scope reported for D9 monitoring.

Temporal scope	BE	CY	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI	Total
1968-9999																+		**1**
1979-9999						+												**1**
1993-9999									+								+	**2**
1998														+				**1**
1998-9999			+															**1**
2002-9999				+														**1**
2003-9999																+		**1**
2004-9999							+											**1**
2005-9999							+								+			**2**
2006-9999													+					**1**
2007-9999											+							**1**
2011-9999					+													**1**
2014-9999	+																	**1**
2016-9999		+																**1**
2021-2026								+		+		+						**3**
Total	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**19**

Regarding the monitoring frequency reported for D9, it can be seen that most MS (13 MS: BE, CY, DK, FI, FR, HR, IE, IT, LV, NL, PL, RO, SE) report a 'yearly' monitoring (Figure 57).

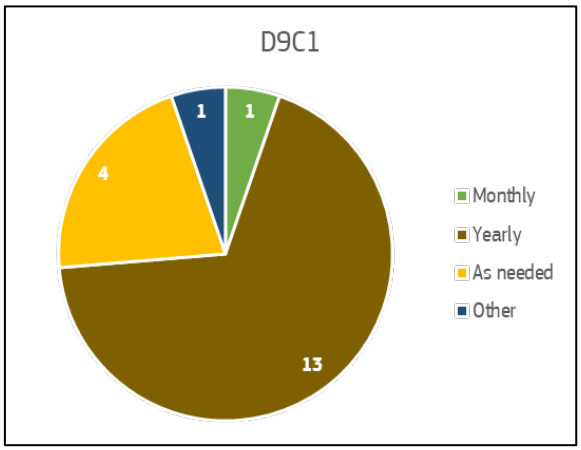


Figure 57. Number of MS declaring each monitoring frequency for D9.

D10

The temporal scope for monitoring D10 varies widely among MS, with 27 different temporal scope categories reported (Table 37). For instance, DE reported eight different temporal categories, while CY, HR, IT, LT, LV, PL, and RO only reported one category. The temporal ranges extends from 1974 to programmes starting in 2021. Moreover, the temporal scope also varies within some MS according to the different elements and parameters monitored (e.g., DE indicated different temporal scope categories for the same marine region and the same environmental compartment).

MS also reported high variable monitoring frequencies within the criteria reported (Figure 58), particularly for D10C1, D10C2 and D10C3. Eight different monitoring frequencies have been reported for D10C1, seven for D10C2 and D10C3, and three for D10C4. The frequency reported more often were 'yearly', followed by 'other' for primary criteria, while for the secondary criteria were 'other' and 'unknown'.

The high variability of the temporal scope and sampling frequency considered by MS hinders the comparability between monitoring programmes, and therefore a certain harmonisation at regional and/or EU level is recommended to facilitate the temporal analysis.

Table 37. Temporal scope reported for D10 monitoring.

Temporal scope	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI	Total
1974-9999					+														**1**
1992-9999					+														**1**
1995-9999					+														**1**
1996-9999														+					**1**
2000-9999			+																**1**
2001-9999				+										+			+		**3**
2002-9999	+		+	+															**3**
2006-9999		+																	**1**
2007-9999						+												+	**2**
2008-9999										+									**1**
2010-9999				+						+									**2**
2011-9999	+							+									+	+	**4**
2012-9999	+		+		+		+	+				+							**6**
2013-9999			+			+		+						+		+			**5**
2014-2021			+																**1**
2014-9999			+			+		+											**3**
2015															+				**1**
2015-9999				+		+		+											**3**
2016-9999					+			+											**2**
2017-2021			+																**1**
2017-9999						+													**1**
2019-9999				+															**1**
2020-2022			+																**1**
2020-2026						+	+												**2**
2020-9999				+		+											+		**3**
2021-2026									+		+		+						**3**
2021-9999								+						+					**2**
Total	**3**	**1**	**8**	**6**	**5**	**7**	**2**	**7**	**1**	**2**	**1**	**1**	**1**	**4**	**1**	**1**	**3**	**2**	**56**

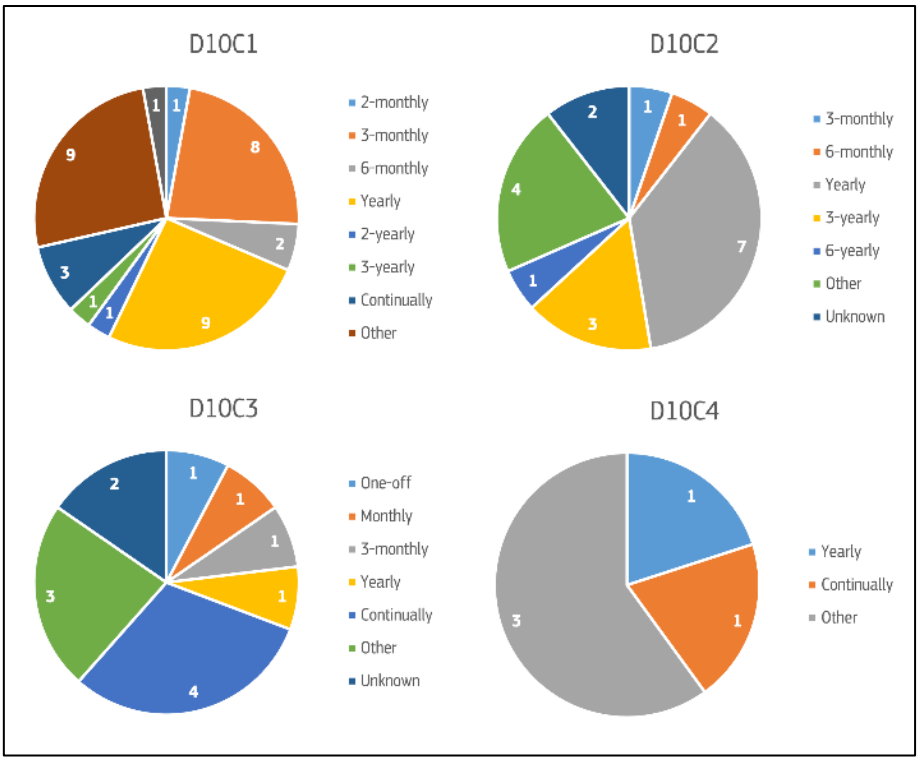


Figure 58. Number of MS declaring each monitoring frequency for D10 criteria.

D11

The temporal scope for monitoring D11C1 and D11C2 is slightly variable across MS. However, all monitoring programs for both criteria have started at recent dates, within the last 15 years, and most of them (75 % for D11C1 and over 90% for D11C2) started after 2014 (Table 38).

Table 38. Temporal scope reported for D11 monitoring.

Temporal scope	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI	Total
2006-9999		+															+		**2**
2008-9999	+																		**1**
2011-9999					+														**1**
2012-9999								+											**1**
2013-9999												+							**1**
2014-9999			+	+	+	+	+										+	+	**7**
2014															+				**1**
2015-9999					+									+			+		**3**
2016-9999								+		+						+			**3**
2017-9999			+																**1**
2018-9999						+													**1**
2019-9999								+											**1**
2020-2026						+													**1**
2020-9999						+		+											**2**
2021-2026									+		+	+							**3**
2021-9999												+		+					**2**
9999-9999													+						**1**
Total	**1**	**1**	**2**	**1**	**3**	**4**	**1**	**4**	**1**	**1**	**1**	**3**	**1**	**2**	**1**	**1**	**3**	**1**	**32**

MS reported different frequencies for the two criteria, which are most probably related to the intrinsic differences in the characteristics and sources of impulsive (D11C1) and continuous (D11C2) sound. Thus, the majority of MS reported that the monitoring of D11C1 takes place either 'as needed' (7 MS: BE, ES, HR, LT, RO, SE, SI), or 'yearly' (6 MS: DE, DK, EE, FR, IE, PL), while most MS (8: DE, EE, FI, LT, LV, NL, SE, SI) indicated a 'continuous' monitoring for D11C2 (Figure 59).

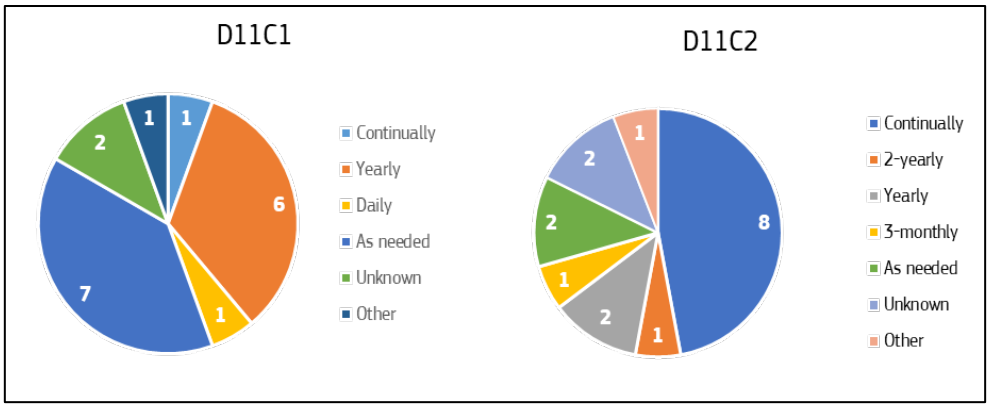


Figure 59. Number of MS declaring each monitoring frequency for D11 criteria.

D1-Marine Mammals

Table 39. Temporal scope reported for D1 monitoring - Marine mammals.

Temporal scope	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI	Total
1960-9999														+					**1**
1969-9999								+											**1**
1975-9999			+														+		**2**
1979-9999				+															**1**
1980-9999							+			+									**2**
1983-9999				+															**1**
1988-9999							+										+		**2**
1990-9999					+														**1**
1991-9999			+																**1**
1994-9999					+			+									+		**3**
1995-9999	+			+															**2**
1998-9999							+												**1**
2000-9999								+											**1**
2001-9999							+												**1**
2002-9999																		+	**1**
2005-9999		+																	**1**
2006-9999			+																**1**
2008-9999			+					+											**2**
2010-9999			+	+												+			**3**
2011-9999				+															**1**
2014-9999														+	+				**2**
2015-9999				+		+						+							**3**
2020-2026						+													**1**
2021-2026									+		+		+						**3**
Grand Total	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**18**

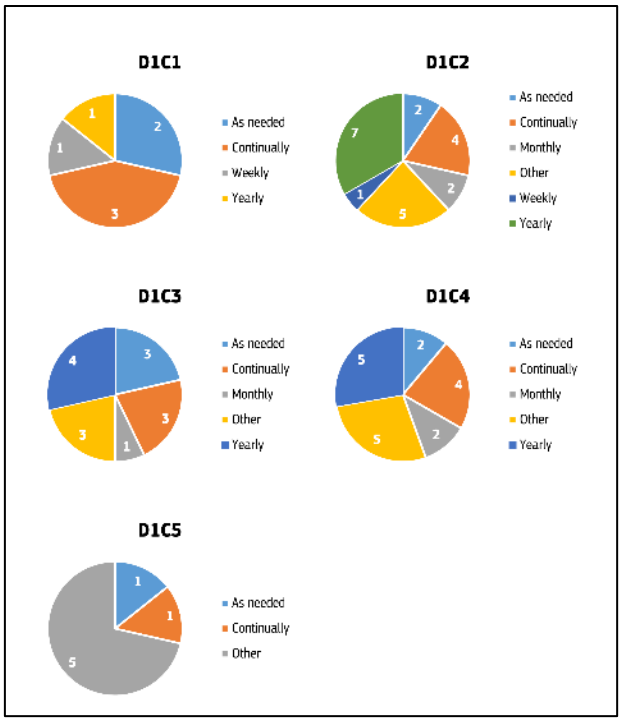


Figure 60. Number of MS declaring each monitoring frequency for D1 criteria - Marine mammals.

D1-Marine Reptiles

Three out of six MS (ES, HR, IT) did not specify the monitoring frequency of sampling for all the criteria. 2 MS (CY, ES) reported 'as needed' for D1C2, D1C3 and D1C4. 2 MS (FR, IE) reported 'continually' for D1C1, D1C2, D1C4 and D1C5. Only 1 MS (IT) reported 'yearly' for D1C3, D1C4 and D1C5.

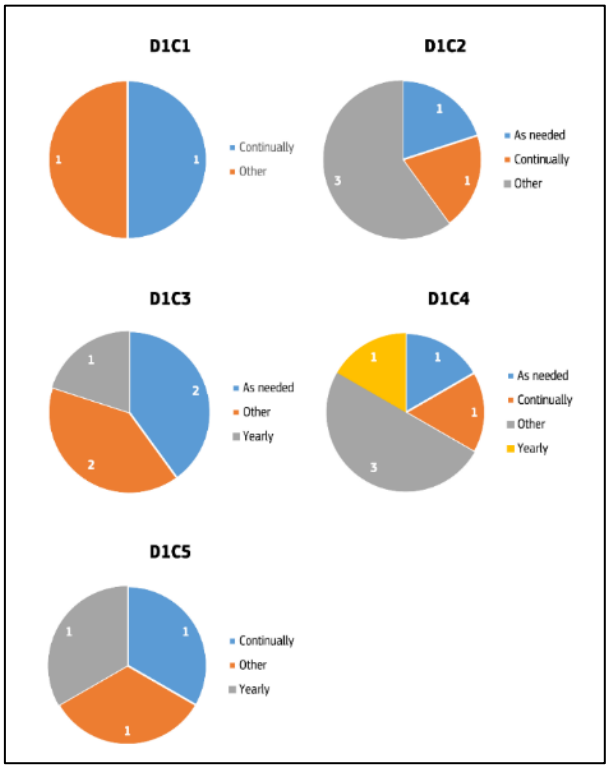


Figure 61. Number of MS declaring each monitoring frequency for D1 criteria - Marine reptiles.

D1-Fish and Cephalopods

Table 40. Temporal scope reported for D1 monitoring - Fish and cephalopods.

Temporal scope	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI	Total
1960-9999														+			+		**2**
1968-9999																	+		**1**
1969-9999																	+		**1**
1972-9999																	+		**1**
1973-9999	+																		**1**
1974-9999			+																**1**
1975-9999					+														**1**
1977-9999			+																**1**
1978-9999			+																**1**
1980-9999							+	+		+									**3**
1981-9999			+																**1**
1983-9999			+	+										+					**3**
1987-9999				+															**1**
1988-9999				+													+		**2**
1990-9999							+												**1**
1991-2015			+																**1**
1991-9999			+																**1**
1992-9999					+							+							**2**
1995-9999				+															**1**
1998-9999			+																**1**
1999-9999			+																**1**
2000-9999			+	+								+				+			**4**
2002-9999			+				+												**2**
2003-9999			+																**1**
2004-9999				+													+		**2**
2005-9999		+		+															**2**
2006-9999																		+	**1**
2007-9999			+																**1**
2008-9999			+	+															**2**
2009-9999										+									**1**
2010-9999										+									**1**
2011-9999															+				**1**
2014-9999			+																**1**
2015-9999						+													**1**
2016-9999						+													**1**
2017-9999								+											**1**
2018-9999								+											**1**
2020-2022				+															**1**
2020-2026						+													**1**
2021-2026									+		+		+						**3**
2021-9999								+											**1**
Grand Total	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**18**

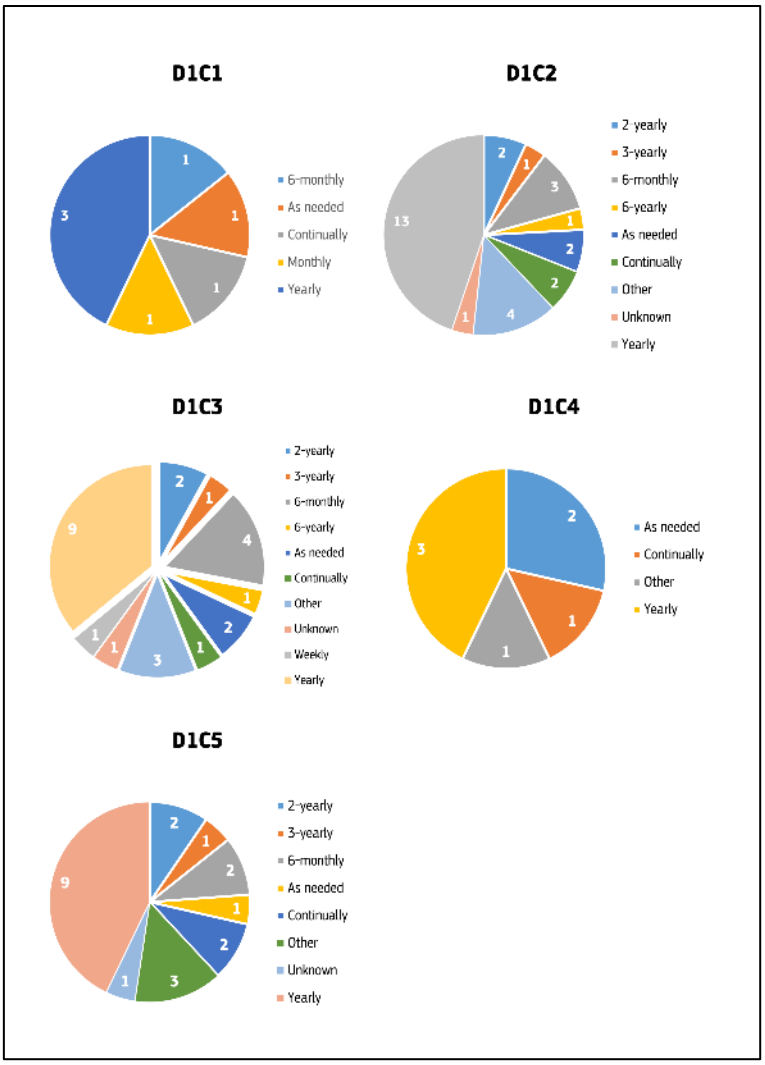


Figure 62. Number of MS declaring each monitoring frequency for D1 criteria - Fish and cephalopods.

D1-Seabirds

Table 41. Temporal scope reported for D1 monitoring - Seabirds.

	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	SE	SI	Total
1948-9999							+											1
1957-9999					+													1
1967-9999					+			+								+		3
1968-9999								+										1
1970-9999			+															1
1971-9999							+											1
1972-9999							+											1
1975-9999							+											1
1980-9999				+			+			+								3
1983-9999																	+	1
1986-9999							+											1
1991-9999														+				1
1992-9999												+						1
1997-9999	+																	1
2004-9999					+									+				2
2005-9999	+	+				+												3
2007-9999								+										1
2008-9999			+															1

	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	SE	SI	Total
2009-9999			+															1
2011-9999															+			1
2015-9999						+									+			2
2020-2026						+												1
2021-2026									+		+		+					3
2021-9999								+										1
2022-9999					+													1
																		17

There is variability in the monitoring frequency, although almost all MS indicated 'yearly' (BE, DE, DK, EE, FI, HR, LV, NL, FR, PL, SE). 6 MS (DE, EE, ES, FI, IT, NL) did not specify the frequency and 3 MS (CY, ES, SI) indicated 'as needed' (Figure 63).

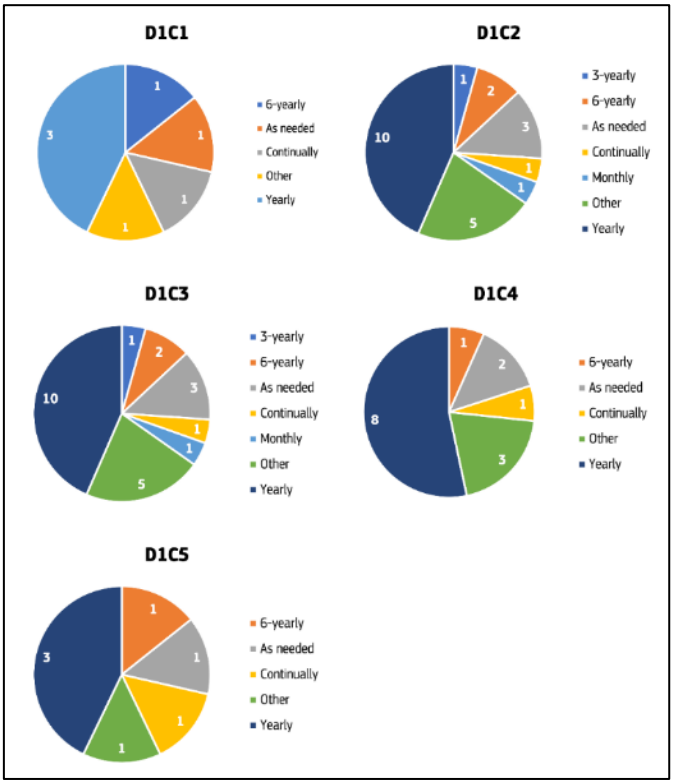


Figure 63. Number of MS declaring each monitoring frequency for D1 criteria - Seabirds.

D1-Pelagic Habitats

The temporal scope of the monitoring programmes ranges from 1774 to 2022.

Table 42. Temporal scope reported for D1C6 monitoring.

Temporal Scope	BE	DE	EE	ES	FI	FR	HR	IT	LT	LV	NL	PL	RO	SE	SI
1774-9999														+	
1893-9999														+	
1952-9999						+									
1957-9999						+									
1958-9999															+
1960-9999													+		
1966-9999													+		
1967-9999														+	
1979-9999		+			+									+	

Temporal Scope	BE	DE	EE	ES	FI	FR	HR	IT	LT	LV	NL	PL	RO	SE	SI
1981-9999									+						
1983-9999		+													
1984-9999						+									
1990-9999											+				
1993-9999			+												
1994-9999														+	
1999-9999												+			
2005-9999		+		+											
2006-9999			+												+
2012-9999	+														
2016-9999		+													
2017-9999	+														
2021-2026							+	+		+					
2022-9999														+	

Monitoring frequency ranges from 'hourly' to 'yearly', depending on the parameter. The monitoring frequency class 'as needed' is reported by SI for monitoring coastal pelagic habitat, but with no further details on the monitoring parameters (i.e., physical, hydrological and chemical characteristics). The most reported frequency is 'other' (Figure 64). This frequency is used for monitoring all the HabPelBHT (Coastal, Shelf, Variable salinity, Oceanic/ beyond shelf) and the HabPelOther (Phytoplankton communities, Zooplankton communities and Diatoms & Dinoflagellates).

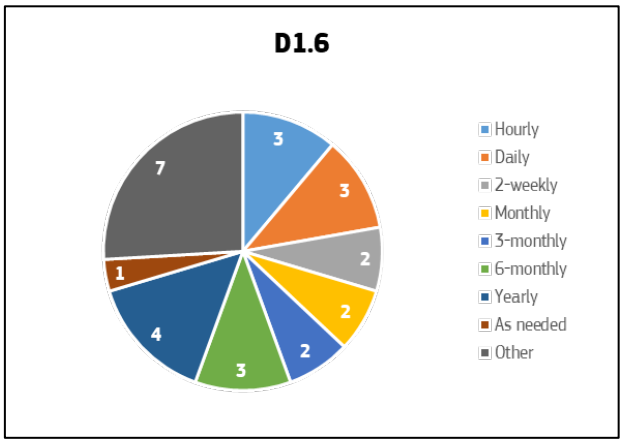


Figure 64. Number of MS declaring each monitoring frequency for D1C6.

D4

The temporal scope for D4 monitoring is extremely variable across MS. The range of dates spans between the 1950s and the last decade. SE is the MS with more temporal scopes, while ES, HR, IT, NL, PL and SI are the MS with only one temporal scope.

Table 43. Temporal scope reported for D4 monitoring.

Temporal scope	DK	EE	ES	FI	HR	IT	LT	NL	PL	SE	SI
1957-9999		+									
1960-9999										+	
1964-9999				+							
1965-9999										+	
1967-9999										+	
1971-9999										+	
1972-9999				+						+	

Temporal scope	DK	EE	ES	FI	HR	IT	LT	NL	PL	SE	SI
1957-9999		+									
1975-9999		+								+	
1979-9999				+						+	
1980-9999				+			+				
1983-9999	+							+			
1988-9999										+	
1990-9999							+				
1991-9999		+									
1992-9999			+				+				
1993-9999		+								+	
1994-9999										+	
2006-9999											+
2011-9999									+	+	
2020-2021	+										
2021-2026					+	+					
2022-9999										+	

In relation to the monitoring frequency, MS reported again variable frequencies within the criteria (Figure 65). For D4C1, seven monitoring frequencies have been reported, for D4C2, eight, for D4C3, five and for D4C4, four. The one reported more often is 'yearly', followed by 'other'. The adequacy of monitoring frequency categories 'as needed', 'other' and 'unknown' cannot be assessed.

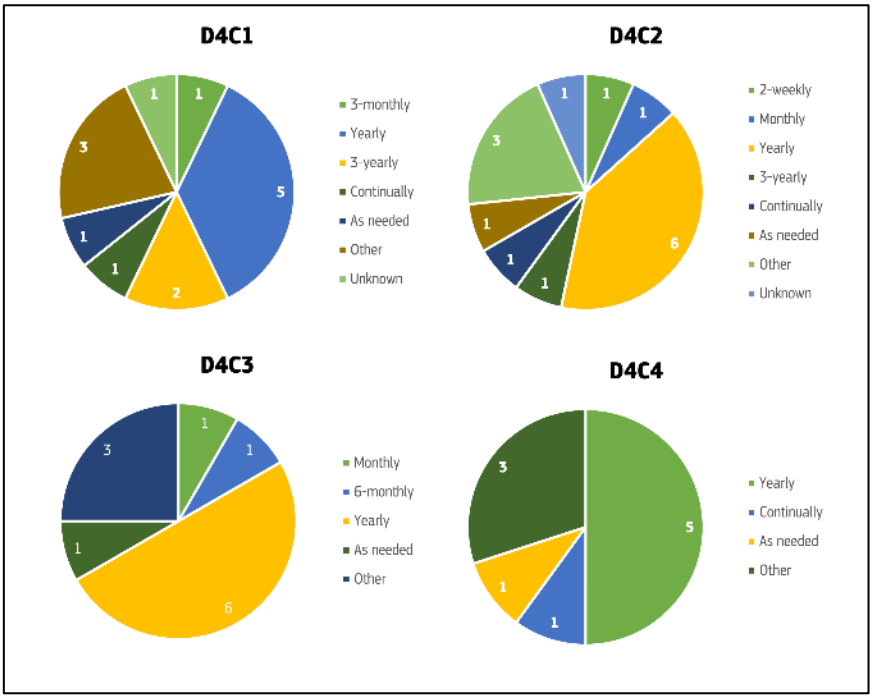


Figure 65. Number of MS declaring each monitoring frequency for D4 criteria.

D6

Table 44. Temporal scope reported for D6 monitoring.

Row Labels	BE	CY	DE	DK	EE	ES	FI	HR	IT	LV	NL	PL	RO	SE	SI
1893-9999														+	
1964-9999							+								
1971-9999														+	
1974-9999					+										
1979-9999	+														

Row Labels	BE	CY	DE	DK	EE	ES	FI	HR	IT	LV	NL	PL	RO	SE	SI
1981-9999					+										
1985-9999	+		+												
1987-9999				+											
1989-9999				+											
1990-9999				+											
1991-9999					+										
1993-9999							+							+	
1995-9999					+										
1999-9999												+			
2000-9999													+		
2005-9999	+	+					+								
2006-9999			+												+
2007-9999															+
2009-9999			+												
2011-9999	+		+											+	
2014-9999												+			
2015-9999	+					+					+				
2016-9999						+									
2020-9999							+								
2021-2026								+	+	+					
2022-9999														+	

Given the number of established monitoring programmes, combined with the numerous elements and parameters, the monitoring frequencies do not reveal any pattern at criterion level. However, this information is essential for the reporting at the parameter level as it could facilitate possible harmonisation and coordination of the monitoring programmes at regional level.

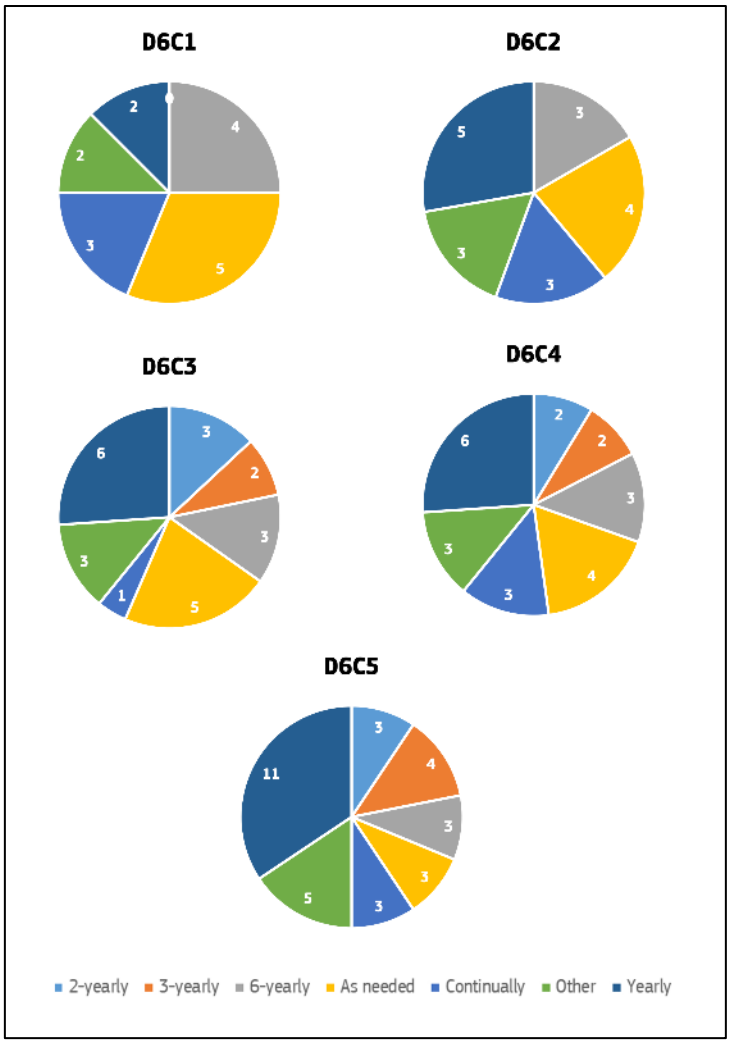


Figure 66. Number of MS declaring each monitoring frequency for D6 criteria.

4.1.4.1 Coherence in the temporal coverage across MS in the marine region

D2

The temporal scopes of the monitoring programmes vary also across regions. In the BLK region, the first monitoring started in 1966 and no new monitoring programmes has been implemented in the following decades. In the BAL region, six monitoring programmes started for D2C1 (DE, EE, FI, LT), five for D2C2 (EE, FI, LT) and two (EE, LT) for D2C3 between 1979 and 2005. In the MED region, there was no monitoring before 2014 for D2C1 and D2C2, and before 2018 for D2C3. In the NEA, the earliest programme started in 1979 for D2C1, while for D2C2, monitoring was planned after the reporting period (2019) (FR, DK, SE) and no temporal scopes is reported for D2C3 (Table 45).

Table 45. Number of MS reporting each temporal scope per marine region and D2 criteria (DK, ES, and SE not included).

	BAL			BLK			MED			NEA		
Temporal scope	**D2C1**	**D2C2**	**D2C3**	**D2C1**	**D2C2**	**D2C3**	**D2C1**	**D2C2**	**D2C3**	**D2C1**	**D2C2**	**D2C3**
1960-9999	1	1										
1966-9999				1	1	1						
1979-9999	1	1								1		
1980-9999	1	1	1									
1985-9999	1									1		
1991-9999	1	1	1									
1993-9999	1	1										
1995-9999	1	1										
2005-9999										1		
2009-9999	1									1		
2010-9999	1	1										
2011-9999			1									
2014-9999		1	1	1			1	1		1		
2015-9999										1		
2016-9999	1							1				
2017-2018										1		
2017-2021	1											
2018-9999									1	1		
2019-9999							1	1		1	1	
2021-2026	1	1					1	1				

D3

No particular differences were detected amongst both the temporal scope and monitoring frequencies reported for each of the three D3 Criteria, hence single relevant tables were compiled for D3 as a whole (Table 46, Table 47). In relation to the temporal scope, there was no consistency amongst MS with regards to the ranges reported within individual regions (Table 46). Nine, four and ten different year ranges were reported by MS in BAL, MED and NEA, respectively. Moreover, there was lack of consistency in the reported monitoring frequency, especially in BAL and MED (Table 47). Notably, in BLK and NEA all MS reported from 'daily' to 'yearly' monitoring frequencies, and they did not report any overly long ('6-yearly') or unclear ('as needed', 'other', 'unknown') monitoring frequencies.

Table 46. Number of MS reporting each temporal scope per marine region and D3 criteria (DK, ES, and SE not included).

Temporal scope	**BAL**	**BLK**	**MED**	**NEA**
1960-9999				1
1972-9999				
1973-9999				1
1974-9999				1
1975-9999	1			

Temporal scope	BAL	BLK	MED	NEA
1978-9999	1			
1980-9999	1		1	1
1981-9999	1			
1983-9999				1
1987-9999				1
1988-9999				
1991-9999				1
1992-9999	2			
1995-9999			1	
1999-9999	1			
2000-9999		1		
2002-9999	2			1
2003-9999				
2004-9999				
2005-9999	1		1	1
2007-9999				
2008-9999				
2009-9999				
2010-9999				1
2011-9999	1			
2016-9999			1	
2018-9999				
2020-2022				
2020-9999				
2021-2026	1		2	

Table 47. Number of MS reporting each monitoring frequency per marine region for D3 (DK, ES, and SE not included).

Monitoring frequency	BAL	BLK	MED	NEA
Daily			1	1
Weekly	1			
Monthly		1	2	1
3-monthly				1
6-monthly	2	1		1
Yearly	3		2	5
6-yearly			1	
Continually	2			
As needed			2	
Other	2		1	
Unknown			1	

D5

Table 48. Number of MS reporting each temporal scope per marine region and D5 criteria (DK, ES, and SE not included).

	BAL								BLK								MED								NEA							
	C1	C2	C3	C4	C5	C6	C7	C8	C1	C2	C3	C4	C5	C6	C7	C8	C1	C2	C3	C4	C5	C6	C7	C8	C1	C2	C3	C4	C5	C6	C7	C8
1924	1																															
1959	1	1							1	1	1	1	1																			
1965	1				1																											
1972	1				1																											
1979		1	1	1	1																											
1980	1	1																							1							
1981				1				1																								
1984																	2	2		1	2				1	1		1	1			
1985									1																							
1989																																
1990	1																								2	1			1			
1991								1																								

	BAL								BLK								MED								NEA							
	C1	C2	C3	C4	C5	C6	C7	C8	C1	C2	C3	C4	C5	C6	C7	C8	C1	C2	C3	C4	C5	C6	C7	C8	C1	C2	C3	C4	C5	C6	C7	C8
1992																									1							
1993	1	1		1	1																											
1994	1																															
1995	1					1	1																									
1997		1	1																													
1999						1	1	1																								
2002																															1	
2005																					1				1	1	1	1	1			
2006			1																			1	1		1	1			1	1	1	1
2007							1																	1					1	1		
2008																														1		
2009														1																		
2010																																
2014	1			1	1	1	1	1																								
2016																		1			1											
2021-2026	1	1	1				1										2	2	1	1	2											
9999		1																														

D7

As seen in Table 49, overall, the ranges of dates indicated by MS within each region are not consistent, with a great variability of starting dates in all regions.

Table 49. Number of MS reporting each temporal scope per marine region and D7 criteria (DK, ES, and SE not included).

Temporal scope	BAL		BLK		MED		NEA	
	D7C1	D7C2	D7C1	D7C2	D7C1	D7C2	D7C1	D7C2
1860-9999					1	1	1	1
1901-9999							1	
1958-9999					1	1		
1960-9999							1	1
1968-9999	1						1	
1970-9999	1						1	
1972-9999	1							
1980-9999	1						1	
1981-9999	2							
1989-9999							1	
1992-9999		1						
1993-9999		1						
1994-9999	1							
1998-9999							1	
2000-9999							1	
2006-9999				1	1		1	
2010-9999							1	
2014-9999	1	1						
2015-9999							1	
2016-9999					1			
2019-9999							1	
9999-9999	1	1						

The most common frequencies indicated by MS are either ‘continuous’ or ‘as needed’, which are very generic

and difficult to assess.

Table 50. Number of MS reporting each monitoring frequency per marine region and D7 criteria (DK, ES and SE not included).

Monitoring frequency	BAL		BLK		MED		NEA	
	D7C1	D7C2	D7C1	D7C2	D7C1	D7C2	D7C1	D7C2
Hourly	1						1	
Weekly	1						1	
Monthly	1						1	
3-monthly	1							
Yearly	1			1			1	
6-yearly	1	1					1	
Continually	1				2	1	1	1
As needed	1				2	1	4	1
Other					1		1	

D8

As seen in Table 51, there is no particular coherence in the temporal scope across MS sharing the same marine region for any D8 criteria. Interestingly, only 7 MS have at least one temporal scope category reported for both D8C1 and D8C2 (DE for 1985-9999, DK for 1998-9999, ES for two periods 1991 and 2006-9999, SE for 2003-9999, and HR, IT and LV for the period 2021-2026).

Table 51. Number of MS reporting each temporal scope per marine region and D8 criteria (all 18 MS are considered).

Temporal scope	BAL				BLK				MED				NEA			
	D8C1	D8C2	D8C3	D8C4	D8C1	D8C2	D8C3	D8C4	D8C1	D8C2	D8C3	D8C4	D8C1	D8C2	D8C3	D8C4
1924-9999	1															
1957-9999		1														
1962-9999														1		
1965-9999		1												1		
1968-9999	1			1									1			1
1970-9999	1															
1974-9999	1								1				1			
1975-9999	1															
1977-9999											1					
1978-9999													1			
1979-9999	1															
1980-9999	1												1			
1983-9999	1												1			
1985	1															
1985-9999	1	1											1	1		
1986-9999															1	
1987-9999													1	1		
1988-9999		1	1											1	1	
1989-9999	1												1			
1990-9999	3												2			
1991-9999									1	ES			1	1	1	
1992-9999	1		1	1												
1993-9999									1				1			

Temporal scope	BAL				BLK				MED				NEA			
	D8C1	D8C2	D8C3	D8C4	D8C1	D8C2	D8C3	D8C4	D8C1	D8C2	D8C3	D8C4	D8C1	D8C2	D8C3	D8C4
1994-9999	3	1												1		
1995-9999	1		1													
1997-9999	1												1			
1998													1			
1998-9999	1	1											1	1		
1999-9999									1							
2000-9999			1		1											1
2001-9999													1			
2003-9999	1	1											1	2		
2005-9999														1		
2006-9999									1	1			2	1	1	
2008-9999													1			
2010-9999	1															
2012-9999	1												1		1	
2013-9999											1	1			1	1
2014-9999	1		1													
2015-9999		1														
2016-9999									1							
2020-2022	1												1			
2021-2026	1	1	1						2	2	1					

Regarding the monitoring frequency, coherence is only found for D8C1 in the Baltic and Atlantic regions and to a lesser extent for D8C2 in the Baltic, where MS mostly report a 'yearly' monitoring frequency (Table 52).

Table 52. Number of MS reporting each monitoring frequency per marine region and D8 criteria (all 18 MS are included).

Monitoring frequency	BAL				BLK				MED				NEA			
	D8C1	D8C2	D8C3	D8C4	D8C1	D8C2	D8C3	D8C4	D8C1	D8C2	D8C3	D8C4	D8C1	D8C2	D8C3	D8C4
Daily			1												1	
Weekly	1		1												1	
Monthly	2												3	1		
3-monthly													1			
Yearly	7	5		1	1				2				7	3		1
3-yearly									2	1				1		
6-yearly	2								1				4	1		
Continually			2												1	1
As needed	1		1						1		3	1	1	1	3	1
Other	6	1	1	1					2	2			4	2		

D9

There is no regional coherence in the temporal scope since different categories are also reported by MS sharing the same marine region (Table 53).

Table 53. Number of MS reporting each temporal per marine region for D9 (all 18 MS are considered).

Temporal scope	BAL	BLK	MED	NEA
	D9C1	D9C1	D9C1	D9C1
1968-9999	1			1
1979-9999	1			
1993-9999			1	1
1998	1			
1998-9999	1			1
2002-9999	1			
2003-9999	1			1
2004-9999			1	1
2005-9999		1	1	1
2006-9999				1
2007-9999	1			
2011-9999			1	1
2014-9999	1			
2016-9999			1	
2021-2026	1		2	

Regarding the monitoring frequency, coherence is again found in the Atlantic and Baltic regions, where most MS monitor with a yearly frequency (Table 54).

Table 54. Number of MS reporting each monitoring frequency per marine region for D9 (all 18 MS are considered).

Monitoring frequency	BAL	BLK	MED	NEA
	D9C1	D9C1	D9C1	D9C1
Monthly			1	1
Yearly	5	1	4	6
As needed	1		2	1
Other	1			

D10

The monitoring frequencies for D10 criteria across marine regions are shown in Figure 67 to Figure 70. MS have reported several monitoring frequencies for each D10 criterion and parameter within all marine regions. For instance, for D10C1, eight, seven, five and one monitoring frequency categories were reported by MS in the BAL, NEA, MED and BLK, respectively, while for D10C2, six, five and four in MED, NEA and BAL, respectively. Therefore, it MS should harmonise the temporal scope and monitoring frequency, at least at regional level.

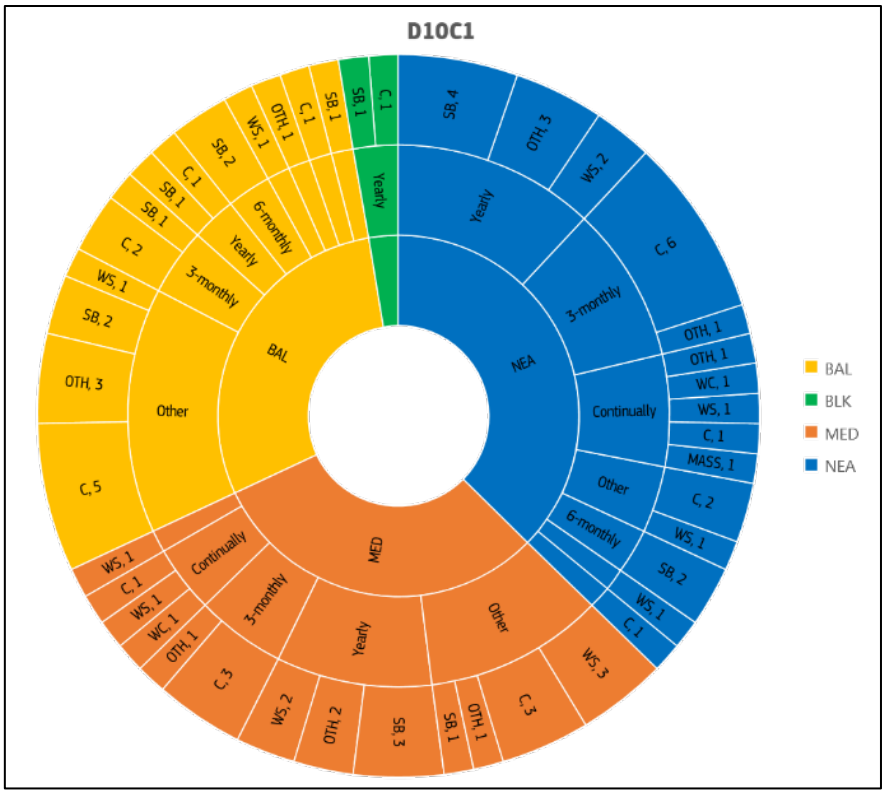


Figure 67. Number of MS reporting each monitoring frequencies for D10C1 parameters per marine region (C: Coastline; WS: Water surface; SB: Seabed; OTH: Other; MASS: mass)

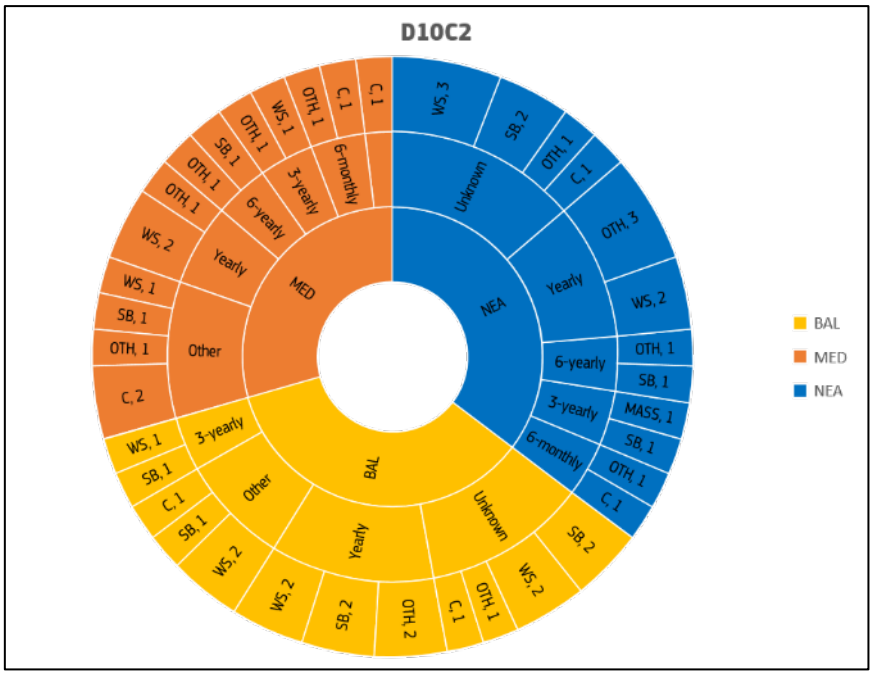


Figure 68. Number of MS reporting each monitoring frequencies for D10C2 parameters per marine region (C: Coastline; WS: Water surface; SB: Seabed; OTH: Other; MASS: mass)

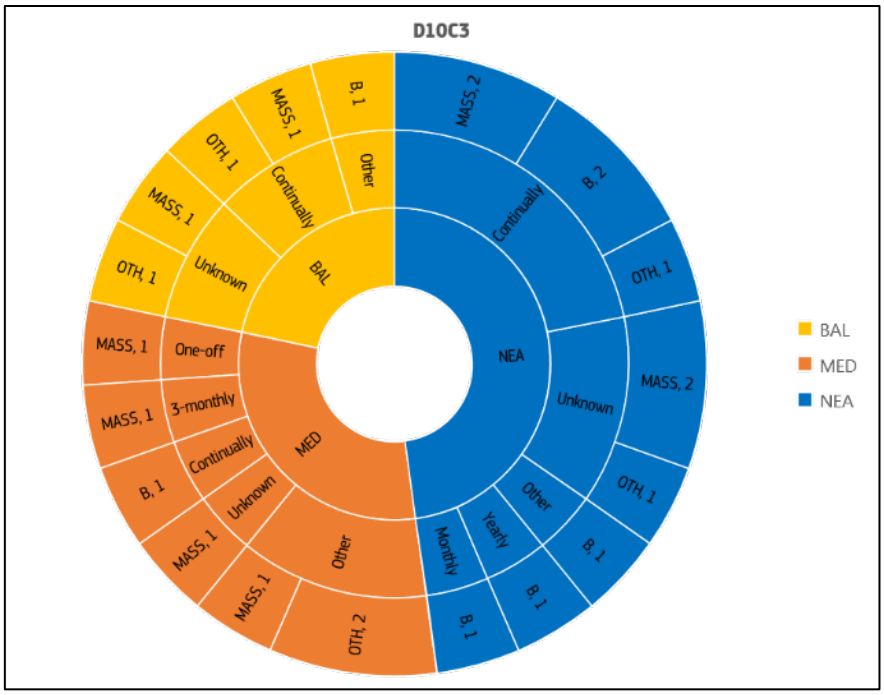


Figure 69. Number of MS reporting each monitoring frequencies for D10C3 parameters per marine region (B: amount on biota; OTH: Other; MASS: mass)

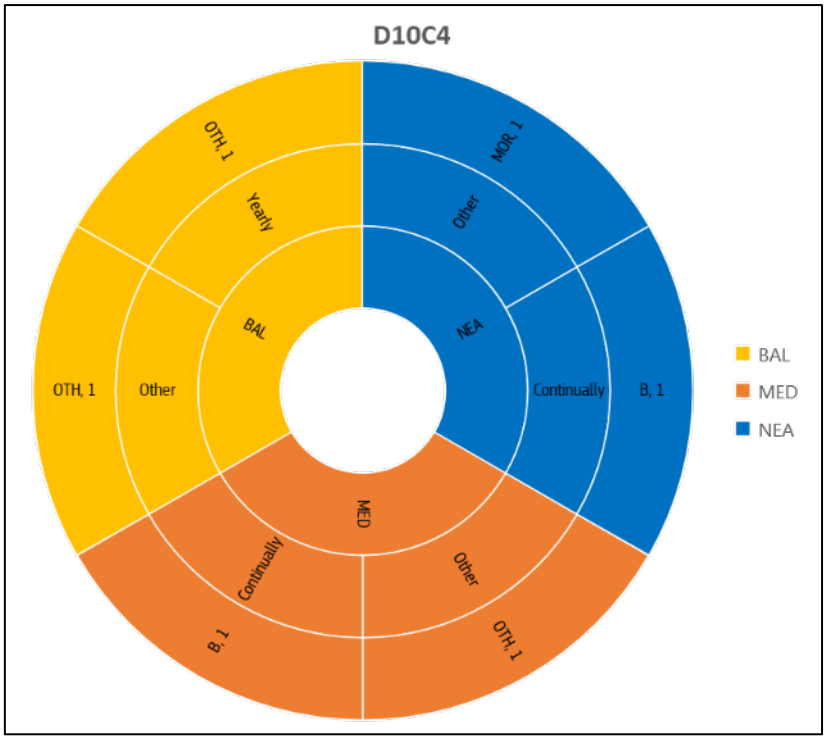


Figure 70. Number of MS reporting each monitoring frequencies for D10C4 parameters per marine region (B: amount on biota; OTH: Other; MOR: mortality)

D11

The temporal scopes of monitoring indicated by MS for D11 across marine regions are shown in Table 55. The features not listed under D11C1 nor D11C2 are not included in the table. Overall, the range of dates indicated by MS within each region is not consistent, with a great variability of starting dates in the BAL, NEA and MED regions. However, most monitoring programmes for both D11 criteria in the four marine regions started after 2014. DK started monitoring D11C1 from 2016 and D11C2 from 2014; ES has monitoring for D11C1 from 2020 and for D11C2 from 2018; and SE has monitoring for D11C1 from 2015, and for D11C2, from 2006 or

2014, depending on the features.

Table 55. Number of MS reporting each monitoring frequency per marine region and D11 criteria (DK, ES and SE not included).

Temporal scope	BAL		BLK		MED		NEA	
	D11C1	D11C2	D11C1	D11C2	D11C1	D11C2	D11C1	D11C2
2006-9999					1	1		
2008-9999							1	
2011-9999	1							
2012-9999						1		1
2013-9999	1							
2014-9999	2	2			1	1	1	
2014	1	1						
2015-9999							1	
2016-9999			1	1	1		2	
2017-9999		1						1
2018-9999								1
2021-2026		1			2	2		
2021-9999		1						1
9999-9999	1							

The frequencies of monitoring for D11C1 and D11C2 across marine regions are shown in Table 56. Also in this case, there is little consistency across MS within each marine region, with the exception of the BAL region, where most MS indicated that D11C2 monitoring is performed 'continually' (6 MS: DE, EE, FI, LT, LV, SE), while 4 MS within the BAL (DE, DK, EE, PL) and the NEA (DE, DK, FR, IE) regions indicated to perform D11C1 monitoring on a 'yearly' basis. The other monitoring frequencies are indicated in a scattered way for both criteria across marine regions.

Table 56. Number of MS reporting each monitoring frequency per marine region and D11 criteria (DK, ES and SE not included).

Monitoring frequency	BAL		BLK		MED		NEA	
	D11C1	D11C2	D11C1	D11C2	D11C1	D11C2	D11C1	D11C2
Daily							1	
3-monthly						1		1
Yearly	4	2			1		4	1
2-yearly						1		
6-yearly								
Continually	1	6				1		3
As needed	2		1	1	3	1	3	1
Other					1	1		1
Unknown	1				1	1		1

D1-Marine Mammals

Consistency in the temporal (as for spatial) scope across regions is not relevant for marine mammals, since different species with different monitoring needs and risks to pressures occupy each region.

In the BLK, the three species (*Delphinus delphis, Phocoena phocoena, Tursiops truncatus*) have the same temporal coverage starting in 2010. In the BAL, the three seals have monitoring programmes started from the 60s, although many more MS reported several monitoring programmes for the same species that started on many different years from the 60s to 2021. In the MED and NEA regions, apart from the seals that have established programmes from the 60s or later, all other groups have the same temporal coverage started in 2015.

Table 57. Number of MS reporting each temporal scope per marine region and D1 criteria - Marine mammals (DK, ES and SE not included).

	BAL					BLK	MED					NEA					
Temporal scope	**D1C1**	**D1C2**	**D1C3**	**D1C4**	**D1C5**	**D1C1**	**D1C1**	**D1C2**	**D1C3**	**D1C4**	**D1C5**	**D1C1**	**D1C2**	**D1C3**	**D1C4**	**D1C5**	**Total**
1960-9999													1	1	1		1
1969-9999								1	1	1		1		1			1
1975-9999			1										1	2	1		2
1979-9999		1		1	1								1		1	1	1
1980-9999	1												1		1	1	2
1983-9999	1											1					1
1988-9999		2		2									1		1		2
1990-9999			1														1
1991-9999		1	1	1	1								1	1	1	1	1
1994-9999		2		1				1		1			2		2		3
1995-9999	1											2	1				2
1998-9999			1														1
2000-9999								1		1			1		1		1
2001-9999		1		1													1
2002-9999							1	1	1	1	1						1
2005-9999								1		1							1
2006-9999		1	1	1													1
2008-9999		1	1	1													1
2010-9999	1					1						1	1	1	1		3
2011-9999		1		1	1								1		1	1	1
2014-9999		1	1	1												1	2
2015-9999	1		1					1	1	1			1	2	1		3
2021-2026	1	1						2	1	2	2						3
Grand Total	**4**	**7**	**6**	**5**	**2**	**1**	**1**	**6**	**4**	**6**	**3**	**3**	**8**	**6**	**7**	**4**	**18**

D1-Marine Reptiles

The Mediterranean and the Northeast Atlantic are the two geographical regions relevant for marine reptiles. Monitoring programs started in 2005 in the Mediterranean and continue to now.

Table 58. MS reporting each temporal scope per marine region and D1 criteria - Marine reptiles.

Region	**Member States**	**Temporal Scope of monitoring programmes**	**Criteria**
MED	CY	2005-9999	D1C2, D1C3, D1C4
MED	HR	2021-2026	D1C1-D1C5
MED	IT	2021-2026	D1C2, D1C3, D1C4, D1C5
MED	FR	2008-9999	D1C1
NEA/MED	ES	2020-2026	D1C2, D1C3, D1C4
NEA/MED	ES	2015-9999	D1C2, D1C3, D1C4
NEA	IE	1980-9999	D1C2, D1C4, D1C5

D1-Fish and Cephalopods

Table 59. Number of MS reporting each monitoring frequency per marine region and D1 criteria - Fish and cephalopods (DK, ES and SE not included).

	BAL					BLK			MED					NEA					
Temporal scope	**D1C1**	**D1C2**	**D1C3**	**D1C4**	**D1C5**	**D1C1**	**D1C2**	**D1C3**	**D1C1**	**D1C2**	**D1C3**	**D1C4**	**D1C5**	**D1C1**	**D1C2**	**D1C3**	**D1C4**	**D1C5**	**Total**
1960-9999		1	1	1											2	1	2	1	2
1968-9999		1													1				1
1969-9999		1		1											1		1		1
1972-9999		1	1	1											1	1	1		1
1973-9999														1	1	1			1
1974-9999														1	1	1	1	1	1
1975-9999		1	1	1															1
1977-9999			1																1
1978-9999		1																	1
1980-9999			1							1					2		1	1	3
1981-9999		1	1	1															1
1983-9999	1	1	1	1										2	2	3	2		3
1987-9999		1	1	1	1										1	1	1	1	1
1988-9999		1	2	1											1	2	1		2
1990-9999		1		1															1
1991-2015		1																	1
1991-9999														1	1	1	1		1
1992-9999	1	2	1	1															2
1995-9999	1	1	1											1	1	1			1
1998-9999															1	1	1		1
1999-9999		1																	1
2000-9999		2	1	1	1	1	1	1							2	2	2	1	4
2002-9999		2																	2
2003-9999		1	1	1															1
2004-9999		2	1	2											2	1	2		2
2005=999															1				1

	BAL					BLK			MED					NEA					
Temporal scope	**D1C1**	**D1C2**	**D1C3**	**D1C4**	**D1C5**	**D1C1**	**D1C2**	**D1C3**	**D1C1**	**D1C2**	**D1C3**	**D1C4**	**D1C5**	**D1C1**	**D1C2**	**D1C3**	**D1C4**	**D1C5**	**Total**
2005-9999		1	1	1						1	1	1	1			1	1		2
2006-9999									1	1	1		1						1
2007-9999															1	1	1		1
2008-9999		1	1	1											2	2	2		2
2009-9999															1		1	1	1
2010-9999															1		1	1	1
2011-9999		1	1																1
2014-9999															1	1	1		1
2015-9999										1	1	1			1	1	1		1
2016-9999										1	1	1			1	1	1		1
2017-9999															1				1
2018-9999										1									1
2020-2022	1	1	1											1	1	1			1
2021-2026		1								2	2	1							3
Grand Total	2	8	6	6	1	1	1	1	1	6	5	3	2	3	8	6	6	4	18

D1-Seabirds

In the MED, there are three monitoring programmes since 1983-9999, 2005-9999 and 2021-2026. In the BAL, there are several ongoing monitoring programmes from 1948, although many MS reported multiple programs for the same species from the 60's to 2021. In the NEA, there are four ongoing monitoring programmes since 1967. ES, reporting for NEA/MED, has monitoring programs much more recent (2005-999; 2015-9999; 2020-2026).

Table 60. Number of MS reporting each temporal scope per marine region and D1 criteria - Seabirds.

	BAL					MED					NEA					
Temporal scope	**D1C1**	**D1C2**	**D1C3**	**D1C4**	**D1C5**	**D1C1**	**D1C2**	**D1C3**	**D1C4**	**D1C5**	**D1C1**	**D1C2**	**D1C3**	**D1C4**	**D1C5**	**Total**
1948-9999	1	1		1												1
1957-9999		1	1	1												1
1967-9999		2	2	2								1	1	1		2
1968-9999							1					1	1			1
1970-9999	1	1		1	1											1
1972-9999			1													1
1975-9999		1		1												1
1980-9999	1	1		1	1							2		2	2	3
1983-9999						1	1	1	1	1						1
1986-9999			1													1
1991-9999												1				1
1992-9999		1														1
1997-9999												1	1			1
2004-9999		1	1										1			2
2005-9999							2	1	2			2	1	1		3
2007-9999												1		1		1
2008-9999	1	1		1	1						1	1		1	1	1
2009-9999													1			1
2011-9999		1														1
2015-9999		1	1	1			1	1	1			1	1	1		2
2021-2026		1				1	2	2	2	1						3
2022-9999		1		1												1
Grand Total	2	8	4	6	2	2	6	4	5	2	1	8	6	6	3	17

D1-Pelagic Habitats

The monitoring programmes for D1C6 inform on the difference between North European countries, that started most of their monitoring programmes before 1999, and the Mediterranean countries that have more recent monitoring (eleven monitoring programmes planned to start during 2021-2022) (Figure 71). Between 1774 and 1999, the BAL countries (FI, EE, LT, SE) started 27 monitoring programmes, whereas the NEA countries (DE, NL) started 19 monitoring programmes. In the same period, MED countries (SI) had only one monitoring programme in place. The new monitoring programmes started before the MSFD implementation (1999-2008) show an increasing monitoring effort in the MED (ES, SI) and NEA countries (BE, DE). MED countries (IT, HR) reported on eleven new monitoring programmes starting between 2021 and 2022, while three new monitoring programmes in the NEA (BE, DE) and five in the BAL (LV, SE) are planned also from 2021. All monitoring programmes in the BLK have started in the first temporal range (1774-1999) (Figure 71).

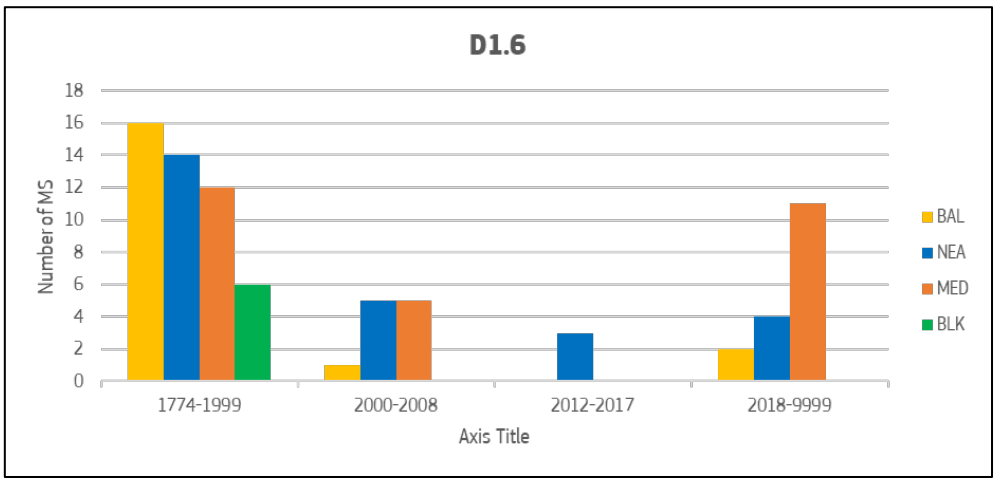


Figure 71. Temporal scopes reported by MS per marine region and time ranges.

Monitoring frequency differs across marine regions. In the Black Sea, monitoring is carried out at '6-monthly' interval for all the elements monitored, whereas in the Baltic Sea, the frequency ranges from 'hourly' to 'yearly' according to tides and/or waves measurements in the Coastal, Shelf and variable salinity pelagic habitats, and zooplankton and phytoplankton communities in Coastal and Shelf Pelagic habitats, respectively. The monitoring frequency 'yearly' is not used in the MED ad NEA regions. 'Other" is the most used frequency in the NEA, and MED. However, MS do not provide more details on this frequency, hence limiting the data analysis and interpretation. Finally, the frequency 'as needed' is reported by SI to monitor physical and chemical parameters of the water column at the Coastal pelagic habitat.

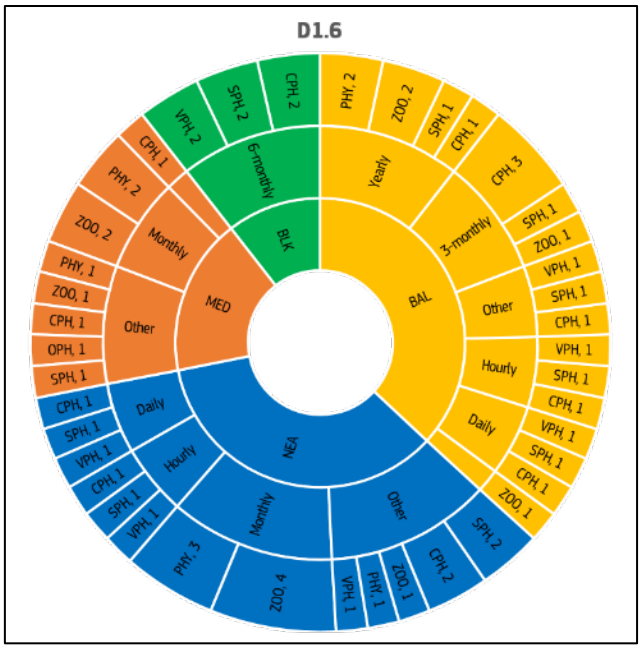


Figure 72. Number of MS reporting each monitoring frequencies for D1C6 parameters per marine region (VPH: Variable Salinity pelagic habitat; CPH: Coastal pelagic habitat; SPH: Shelf pelagic habitat; OPH: Oceanic and beyond shelf pelagic habitat; PHY: Phytoplankton Communities; ZOO: Zooplankton communities).

D4

The temporal scope for monitoring D4 is extremely variable across marine regions and criteria. As shown in Table 61, the range of dates spans between the 1950s and the last decade. BAL is the region with more temporal scopes, particularly for D4C1 and D4C2.

Table 61. Number of MS reporting each temporal scope per marine region and D4 criteria (DK, ES and SE not included).

	BAL				MED				NEA			
Temporal scope	**D4C1**	**D4C2**	**D4C3**	**D4C4**	**D4C1**	**D4C2**	**D4C3**	**D4C4**	**D4C1**	**D4C2**	**D4C3**	**D4C4**
1957-9999	1	1		1								
1960-9999	1	1	1						1	1	1	
1964-9999	1	1	1									
1965-9999				1								1
1967-9999	1	1	1						1	1	1	
1971-9999	1	1							1	1		
1972-9999	1	1	1	1					1	1	1	
1975-9999	1	1		1								1
1979-9999	2	2	1	2					1	1		1
1980-9999	2	1										
1983-9999	1	1	1	1					1	1	2	1
1988-9999	1	1							1	1		
1990-9999			1									
1991-9999	1	1										
1992-9999		1	1		1	1	1	1	1	1	1	1
1993-9999	2	2	1						1	1		
1994-9999		1								1		
2006-9999					1	1	1					
2011-9999	2	1	2							1	1	
2020-2021	1	1	1	1					1	1	1	1
2021-2026					2	2	1	1				
2022-9999	1	1							1	1		

The frequency for monitoring D4 is extremely variable across marine regions and criteria. Also here, BAL was the region with more different monitoring frequencies, particularly for D4C1 and D4C2.

Table 62. Number of MS reporting each monitoring frequency per marine region and D4 criteria (DK, ES and SE not included).

	BAL				MED				NEA			
Monitoring frequency	**C1**	**C2**	**C3**	**C4**	**C1**	**C2**	**C3**	**C4**	**C1**	**C2**	**C3**	**C4**
2-weekly		1								1		
3-monthly	1											
Monthly						1	1					
6-monthly			1									
Yearly	4	5	4	4	1	1	1	1	3	3	4	3
3-yearly	1				1	1						
Continually	1	1		1								
As needed				1	1	1	1					1
Other	2	2	3	2	1	1		1	2	2	2	2
Unknown					1	1						

D6

As it was expected, many MS have long established monitoring programmes for the benthic habitats, either as a result of other relevant policies (HD, WFD) of because of national programmes. Table 63 provides the temporal scope of programmes per criterion.

Table 63. Number of MS reporting each temporal scope per marine region and D6 criteria (DK, ES and SE not included).

	BAL					BLK					MED					NEA				
	D6C1	**D6C2**	**D6C3**	**D6C4**	**D6C5**	**D6C1**	**D6C2**	**D6C3**	**D6C4**	**D6C5**	**D6C1**	**D6C2**	**D6C3**	**D6C4**	**D6C5**	**D6C1**	**D6C2**	**D6C3**	**D6C4**	**D6C5**
1860-9999											1	1	1			1	1	1		
1893-9999					1															1
1955-9999																1				
1960-9999																	1			
1964-9999					1															
1967-9999	1	1					1									1	1			
1970-9999							1				1	1	1			1	1	1		
1971-9999					1															1
1974-9999					1															
1979-9999																		1		1
1981-9999	1				1															
1985-9999																		1		2
1986-9999		1	1														1	1		
1987-9999				1	1														1	1
1989-9999				1	1														1	1
1990-9999				1	1														1	1
1991-9999				1	1															
1992-	1	1	1	1																

	BAL					BLK					MED					NEA				
	D6C1	D6C2	D6C3	D6C4	D6C5	D6C1	D6C2	D6C3	D6C4	D6C5	D6C1	D6C2	D6C3	D6C4	D6C5	D6C1	D6C2	D6C3	D6C4	D6C5
9999																				
1993-9999					2															1
1995-9999					1		1									1	1			
1999-9999					1															
2000-9999																				
2004-9999							1									1	1			
2005-9999	1	2	2	1	1					1	1	1	1	1	1	2	2	4		1
2006-9999				2										1	1				2	1
2007-9999			1								1	1	2	1	1			1		
2009-9999												1	1				1	1		1
2010-9999	1															1	2	2		
2011-9999																1	1	1		3
2012-9999		1	1									1	1			2	2	1	1	
2013-9999																	1			
2014-9999	1	1			1											1	1			
2015-9999													1	1				3	1	3
2016-9999													1	1	1			1	1	1
2018-9999																1	1			
2020-9999					1						1	1				2	2		1	
2021-2026	1	1									1	1	1	2	2			1	1	1
2022-9999			1	1	1													1	1	1

4.2 Consistency and adequacy of collected data

This section presents a general overview (a qualitative analysis based heavily on the structure of the Art. 11 reporting fields) on whether the monitoring programmes provide sufficient and useful information to address Art. 8 assessments and GES coverage as well as to assess progress with the targets and the measures taken.

4.2.1 Links with Art. 8 (Assessment)

MSFD Article 11 requires that monitoring programmes should be established and implemented for the ongoing assessment of environmental status. There are substantial differences in the "degree of maturity" of the different descriptors and, consequently, in the adequacy/consistency of the reported information to understand whether the monitoring performed by MS is sufficient to address Art 8. Nevertheless, some general remarks can be drawn from the analysis of the reported information.

According to the monitoring reporting guidance (MSFD Guidance Document 17), it is expected that typically only one 'monitoring purpose' category will be relevant per programme. However, several "purposes" are often considered for each monitoring programme of each descriptor. Figure 73 shows the monitoring purposes reported by MS (split per categories and criteria).

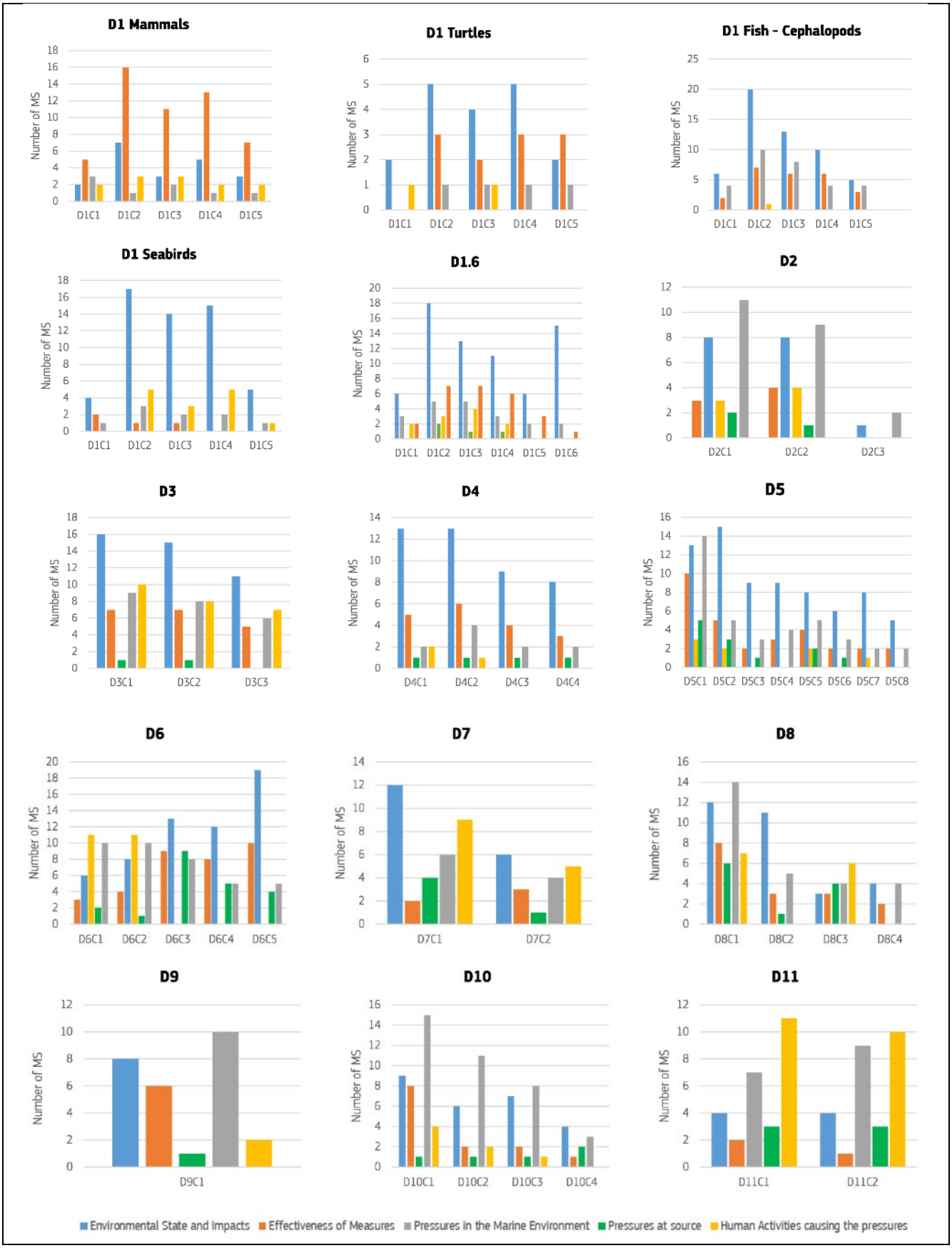


Figure 73. Monitoring purposes reported by MS for the different Descriptors/criteria.

4.2.1.1 In relation to the assessment of state/impacts

D2

D2C3 is the relevant criterion for evaluating whether the monitoring in place is sufficient and useful to address Art. 8 in relation to the assessment of state/impacts, and Species and Habitats the relevant features.

Only 5 MS (EE, LT and PL in the Baltic Sea, RO in the Black Sea and SI in the Mediterranean Sea) out of 18 MS have monitoring in place for D2C3. Among the features listed, MS have not always set monitoring on features relevant to assess Art 8 state/impact and progresses on D2C3, but features relevant to pressures in the marine environment (i.e., 'PresBioIntroNIS'). Regarding the monitoring purpose, 'Environmental State and Impacts' is selected with 'Pressure in the marine environment' by 2 MS (EE, LT).

Only for 1 MS, the strategy focuses on monitoring species, benthic and pelagic, and their metrics (abundance, biomass, composition) at risk from NIS. For other MS, the description of the strategy is very broad and out of D2C3 scope.

D5

D5 has 7 criteria designed for monitoring the state and impact of the marine environment. However, often the monitoring programmes in place cover more than one purpose including state/impacts, pressures and effectiveness of measures.

Two MS (EE, SE) fully comply with the monitoring requirements for assessing Art. 8 state/impacts.

FR and CY did not report 'Environmental state and impact' as monitoring purpose for D5C2, and PL did not report for D5C2. The primary criterion D5C5 was reported by 10 out of 18 MS, of which 8 MS (DE, DK, EE, ES, ES, FI, HR, IE, IT) reported 'Environmental state and impact' and 4 MS (DK, ES, IE, IT) 'Effectiveness of measures'.

The secondary criteria D5C3 and D5C4 were reported for monitoring 'Environmental state and impact' by 9 MS (DE, EE, ES, FI, HR, LV, RO, SE, SI and DE, DK, EE, ES, HR, LT, PL, RO, SE, respectively).

The secondary criteria D5C6, D5C7 and D5C8 were reported for monitoring 'Environmental state and impact' by 6 MS (EE, IE, PL, RO, SE, SI), 8 MS (EE, FR, IE, LT, LV, PL, SE, SI), and 5 MS (EE, IE, LT, SE, SI) respectively.

D7

Hydrographic conditions are described based on the physio-chemical characteristics of the water body, such as temperature, ice cover, salinity, depth, currents, waves and turbidity, which are partly determined by natural conditions, but may also be influenced by human activities. State and impact monitoring for D7 aims to collect data on hydrographic conditions and their permanent changes, determined by changes in the water column, the seabed and the benthic habitat types. The purpose of hydrographic changes monitoring, under D7C2, is also to assess whether such permanent changes in hydrographic properties adversely affect the marine ecosystems. The main relevant features for the assessment of D7 state and impact are 'CharaPhyHydro', 'CharaChem', and 'HabBenBHT' – 'HabBenOther' for the assessment of the ecosystem components, within both D7C1 and D7C2, and 'PresEnvHydroChanges', for the assessment of pressures and impacts in the marine environment, within D7C1. 'Environmental State and Impacts' was identified as monitoring purpose by 12 MS (DE, EE, ES, HR, IE, IT, LT, LV, NL, RO, SE, SI), most of which indicated it as the main scope for monitoring the feature 'PresEnvHydroChanges', within D7C1, and with a smaller number of MS indicating it as the aim for D7C2 monitoring. However, the monitoring strategy descriptions provided by MS make it possible to determine that all monitoring plans detailed by MS targeted in some way the assessment of environmental state and impacts at least for some of the elements considered. Indeed, within the BAL region, DE indicates the permanent and regular recording of the hydrographic basic parameters; DK, EE, LT and LV the ongoing monitoring of environmental conditions and physical characteristics of marine ecosystems; FI the continuous recording of salinity and temperature; PL the collection of information on water column physical characteristics; and SE the monitoring of changes in hydrographic conditions to provide a basis to distinguish the effects of human impacts from those of climate change. The same do DE, DK, and SE in NEA region, along with NL, which indicates monitoring of species, habitats and hydrographical characteristics; BE and ES, which indicate the monitoring of environmental impacts; and FR and IE, indicating that the aim of monitoring is the permanent assessment of the ecological state and alterations of hydrographic conditions. In the MED region, ES, CY, FR, HR, SI and IT also indicate assessing the impact of permanent hydrographical conditions, spatial extent of habitats affected by permanent alteration status, and monitoring of state and impacts, among the purposes of monitoring, while in the BLK region, RO indicates the monitoring of relevant habitat distribution and anthropic development.

Thus, according to the information provided at this stage, all the 18 MS reporting for D7 have in place sufficient

monitoring to address Art 8 assessment of state and impacts at least for some of the features and/or elements they are considering within this descriptor.

D8

For D8, "impact" mainly relates to criteria D8C2 and D8C4. For D8C2, most MS (DE, EE, ES, FR, HR, IE, IT, LV, NL, PL, SE) report 'Environmental State and Impacts' as monitoring purpose, although, as said above, often not as a single category. Moreover, the monitoring purpose in SE varies according to the D8C2 parameter assessed. Some MS (BE, DE, DK, EE, ES) indicate "pressures" as D8C2 monitoring purpose, which should not be the main purpose for those criteria (Figure 73). As described above (4.1.1 and 4.2.2), 14 MS (BE, DE, DK, EE, ES, FI, FR, HR, IE, IT, LV, NL, PL, SE) address D8C2 in their monitoring programmes, but the parameters used to assess the effects of contaminants are very limited and highly variable. Actually, less biological methods are reported under Art 11 than under last Art 8 reporting.

Only 4 MS (EE, ES, FR, SE) address D8C4 in their monitoring programmes and all of them report as monitoring purpose for this criterion both 'Environmental State and Impacts' and 'Pressures in the marine environment'. Potential parameters to assess the impacts of acute pollution events are only defined by 2 MS (EE, SE), while 3 MS (DK, ES, BE) indicate that the program will monitor the adverse effects of these episodes, but there are still a lack of methodological standards and several implementation gaps.

Taking into account those findings, the current monitoring is not considered to be sufficient to address Art 8 assessment of impacts of contaminants (D8C2 and D8C4).

D10

For D10, several monitoring purposes were considered for each monitoring programme.

D10C4 is the relevant criterion to evaluate the environmental state and impacts for the data collected through the monitoring programmes. Only 3 MS (DE, EE, SI) have monitoring in place for this criterion. However, among the reported features, only 1 MS (DE) reported in the corresponding feature 'PresEnvAdvEffectsSspHab' and indicated potential parameters to assess the impacts of marine litter, while EE and SI reported on 'PresInputLitter' for D10C4. EE indicated in the monitoring programme description and gaps that there are not common harmonised micro-litter monitoring methodologies for different matrixes, including biota.

According to the findings, the monitoring should not be considered sufficient to address Art. 8 assessment of impacts from marine litter.

D11

State and impact monitoring for D11 aims to collect data on the spatial and temporal distribution of anthropogenic impulsive sound and low-frequency continuous noise by assessing the features 'PresEnvSoundImpulsive' and 'PresEnvSoundContinuous'. Although according to the monitoring guidance, it is expected that only one monitoring purpose category would be relevant per each monitoring programme, MS often consider several purposes for each programme (Figure 73). 'Environmental State and Impacts' was reported as monitoring purpose only by 4 MS for both features (CY, ES, LT, PL). However, within the monitoring strategy description provided by MS, it was possible to identify a few more monitoring plans targeting the assessment of environmental state and impacts. Indeed, DE, DK, FI, PL and SE within the BAL region indicated ongoing monitoring of the environmental status or condition related to underwater noise; the same did BE, DE, DK, ES and FR within the NEA region, with BE indicating setting baselines as one of the objectives of monitoring. In the MED region, CY, ES, FR, HR, and SI also indicated assessing the status, and the impact of noise among the purposes of monitoring.

Thus, according to the information provided at this stage, 11 out of the 18 MS reporting for D11 have in place sufficient monitoring to address Art 8 assessment of state/impacts.

D1-All species groups

The majority of MS use the monitoring programmes to assess the state of the species (Figure 73), in line with the requirements of the GES Decision. However, there are gaps in monitoring. For instance, for mammals, only half of the MS reported programmes and this monitoring purpose for D1C1, for fish and cephalopods, only D1C2 is well covered, and for seabirds, less than 25% of the MS reported programmes and this monitoring purpose for D1C1 and D1C5.

D1-Pelagic Habitats

State/impact monitoring for D1C6 aims to collect data on the features pelagic broad habitats ('HabPelBHT') and other broad habitats ('HabPelOther').

All MS reporting on this criterion have indicated 'Environmental State and Impacts' as monitoring purpose for both features. For EE and SE, the monitoring purposes also cover also 'Pressures in the marine environment', and for SE the 'Effectiveness of measures'.

The monitoring strategy described by MS includes the rationale of the monitoring carried out on biological communities (i.e., phytoplankton and zooplankton) and their taxonomic and biodiversity metrics, but often there are no details (7 MS) on how the monitoring is targeting the state/impact of pelagic broad habitats. 6 MS (BE, EE, FI, LT, SE, FR) have declared to have monitoring programmes in place to inform on the state and impact of pelagic habitats, while 2 MS (NL, SI) have not yet monitoring set up.

D4

For D4C1 and D4C2, 16 MS over 16 MS reporting for the Descriptor, reported 'Environmental state and impact' as monitoring purpose. Respectively, 9 MS and 8 MS reported this monitoring purpose under D4C3 and D4C4. 'Effectiveness of measures' was reported by 4 MS (DK, EE, IT, SE) for D4C1, 5 MS (DK, EE, HR, IT, SE) for D4C2, 4 MS (DK, EE, HR, SE) for D4C3, and 2 MS (DK, SE) for D4C4. The monitoring purpose 'Human activities causing the pressures' was reported by EE and FI for D4C1 and D4C2, respectively for monitoring species composition and abundances of fish community at coastal habitat ('EcosysCoastal') and abundance of Cyprinidae at coastal habitat ('EcosysCoastal'). 'Pressure at source' was reported by DK, IT, EE for D4C1 and DK, EE IT, HR for D4C2. DK and HR reported also 'Pressure in the marine environment' for D4C3, whereas DK and EE did so for D4C4.

D6

The monitoring purpose reported for each programme for D6 is summarised in Figure 73 and indicates that the majority of MS use these programmes to assess the state of the habitats for the criteria D6C3-D6C5 and pressure for D6C1 and D6C2, in line with the GES Decision requirements.

4.2.1.2 In relation to the assessment of pressures at sea and pressure at source

D2

The monitoring purpose pressure/activities for D2 include addressing the pressure criteria D2C1 and D2C2 and the features 'PresEnvNISnew', 'PresBioIntroNIS', 'PresBioIntroMicroPath' and 'PresEnvNISestablished'.

For D2C1, 16 out of 18 MS (BE, DE, DK, EE, ES, FI, FR, HR, IE, LT, LV, NL, PL, RO, SE, SI) have addressed the 'PresEnvNISnew', 'PresBioIntroNIS', 'PresBioIntroMicroPath' features for both pressure/activities and state/impacts. In this regard, more than one monitoring purpose is assigned to single monitoring programmes. Looking at the strategy descriptions provided by MS, they are quite general and often do not provide the monitoring rationale to collect data on new introductions. However, by looking at other monitoring fields, such as 'Programme Description', 'Monitoring Details', 'Temporal Scope', and 'MonitoringFrequency', it is possible to understand whether the monitoring is targeting new NIS introductions. For MS reporting in the NEA, only one (NL) does not have yet a specific monitoring in place for D2, despite monitoring surveys are carried out on species groups (macrozoobenthos, plankton, and fish) every year or once every three years under national and regional (OSPAR) programmes. Other MS include in their monitoring programmes not only surveys on new introduction at man-made structures (e.g., ports, windfarms, aquaculture -BE, DK, SE, ES), but also on established NIS (distribution, abundance and biomass, e.g., DK), or their adverse effect on protected areas and habitats (e.g., ES). For MS reporting in the MED, two MS (FR and HR) have only started D2C1 monitoring in 2019 or 2021. Finally in the Black Sea, RO is providing little information on the monitoring strategy adopted to collect data on new introductions.

For D2C2, 12 MS (CY, DK, EE, ES, FI, FR, IT, LT, PL, RO, SE, SI) have addressed the 'PresEnvNISestablished' feature with main monitoring purposes pressure/activities and state/impacts. Monitoring focuses on several groups of species and their abundance, biomass in hotspot areas (ports and aquaculture, e.g., DK, IT) and habitats (e.g., CY, LT). 2 MS (RO and SI) provided some information on how monitoring is carried out to investigate the abundance and spatial distribution of established NIS.

D3

With few exceptions (FR, NL, PL, RO, SI), several 'purposes' are usually considered for each monitoring programme under D3, and they are mentioned in the same reporting cell.

D3 criteria are listed under Part I ('pressures and impacts') of the GES Decision. However, for D3 'pressure' mainly relates to D3C1, while D3C2 and D3C3 describe the 'state'. Nevertheless, the split observed along the different categories of monitoring purpose reported by the MS is similar for all three D3 criteria (Figure 73). Notably, 5 MS (NL, PL, RO, SE, SI) do not mention any type of 'pressure' in the monitoring purpose of the pressure criterion D3C1. 'Environmental State and Impacts' is the most common monitoring purpose reported for the D3 criteria (reported by all except FI and HR), although typically not as a single category.

As D3C3 monitoring is lacking for 5 (LV, FR, ES, IE, NL) of the 18 MS, the current monitoring is less sufficient to address the assessment of this criterion compared to D3C1 and D3C2.

The 'MonitoringStrategyDescription' provided by MS varied in length and detail, ranging from 1-2 sentences (LV, BE, RO) to a few paragraphs (DE, ES IT, DK, SI). Some descriptions only made a reference to regulations/manuals without providing much further detail (LT, PL, EE, SE), while other descriptions focused more on the general management and status of the fisheries resources rather than the monitoring strategy (HR, CY, SI).

With all the caveats mentioned in this and previous sections, monitoring for D3 is at a satisfactory level, at least for the main D3 Criteria D3C1 and D3C2, where monitoring is closely aligned to the Data Collection Framework (DCF) of the CFP, but there is still potential for improvement.

D5

D5C1 is the only pressure criterion for Eutrophication and has been reported by the 18 MS. 4 MS (CY, DK, FI, PL) didn't report 'pressures at the sea' or 'pressure at source' as monitoring purpose for this criterion. LT specifically declared that the monitoring is not sufficient for assessing the environmental pressures on intermediate waters and along the coasts because of the limited spatial coverage of the sampling stations and the lack of satellite observations.

11 MS highlighted the need of improving the monitoring programmes with technological solutions (i.e., ferry boxes, remote sensing, numerical modeling, and new methods for analysing nutrients) for a better temporal and spatial coverage of the monitoring. Lack in coordination and funds are also identified by 2 MS as limiting factors in performing an adequate monitoring.

D7

Pressures and activities monitoring for D7 aims to collect data on physical interventions, influences on hydrological processes or changes in habitats that may result in any lasting change in the hydrographical conditions of marine ecosystems or that may lead to a risk to species and habitats. This is mainly done by identifying the main human activities that may produce such changes and by assessing human-induced pressures that may cause hydrographic changes. The relevant purposes of monitoring for the assessment of pressures were indicated by a variable number of MS. Overall, 9 MS (CY, DK, EE, ES, FI, FR, IE, IT, SE) indicated either assessment of the human activities causing the pressures, pressures at source or in the marine environment as the scope for monitoring the feature 'PresEnvHydroChanges' (either within D7C1 or D7C2), 10 MS (BE, CY, DK, EE, ES, FI, FR, IE, IT, SE) did so for D7C1 monitoring and 5 MS (DK, ES, FI, FR, LV) for D7C2 monitoring (Figure 73). Moreover, activity-related features were also considered by the MS monitoring plans aimed to identifying human activities causing the pressures and assessing the related pressures. Overall, 11 MS (BE, CY, DK, EE, ES, FI, FR, IE, IT, LV, SE) addressed the monitoring of pressures and/or activities within their programmes; in some cases, the assessment of activities liable to produce adverse effects on the hydrographic conditions are scrutinized and subject to national EIA procedures (e.g., LV, ES, IT).

Thus, according to the information provided at this stage, not all the MS reporting for D7, but still a majority of them, have in place sufficient monitoring to address Art. 8 assessment of pressures at sea and pressures at source.

D8

For D8, "pressure" mainly relates to criteria D8C1 and D8C3. For D8C1, most MS (BE, DE, DK, EE, ES, FI, FR, HR, IE, LV, NL, RO, PL, SE, SI) report 'Pressures in the marine environment' as monitoring purpose, although often not as a single category. Many MS also report 'Pressures at sea' (6 MS: DK, EE, FI, IE, NL, SI) and 'Environmental state and impacts' (14 MS: BE, DE, DK, EE, ES, FI, HR, IE, IT, LT, LV, PL, SE, SI), which should not be the main purpose for this criterion. Indeed, 3 MS (FI, LT, PL) have reported 'Environmental state and impacts' as a single purpose for some of their monitoring programmes.

As described above, all 18 MS address D8C1. Although the number and type of elements and parameters vary widely among MS, the current monitoring provides sufficient information to address the pressure by contaminants in most MS (especially in relation to the substances covered under the WFD and the RSC lists).

Actually, some MS (e.g., DK and RO) report in their monitoring programmes more elements/parameters than they did under the last Art 8 reporting. Nevertheless, in some MS, the monitoring programmes are limited and focused on very few elements/parameters (e.g., CY). Furthermore, it is difficult to evaluate the adequacy of the monitoring for IT and SI, since they do not specify which elements are monitored.

Considering those findings, the monitoring of hazardous substances can be overall considered to be sufficient to assess D8C1 and for following up the progress towards achieving GES. However, there is potential for improvement and gaps that should be addressed, in particular regarding the coverage of additional contaminants and the coverage of open sea areas.

Regarding D8C3, the monitoring purposes reported vary among MS (Figure 73). 'Human activities causing the impact' is the most common purpose (BE, DK, EE, FI, LV, SE), while 4 MS (HR, LV, NL, SE) indicate 'Pressures as source'. 4 MS (EE, ES, IE, SI) and 3 MS (BE, EE, ES) indicate 'Pressures in the marine environment' and 'Environmental state and impacts', respectively, which should not be the most relevant purposes for monitoring this criterion.

11 MS address D8C3 in their monitoring programmes, but, for instance, HR does not provide monitoring details and only highlights the lack of relevant methodological standards for this criterion. Moreover, there are differences among MS. For instance, ES analyses the national register of accidental discharges from ships and platforms, while SI collects data on the distribution of oil spills in accordance with the Directive 2005/35/EC on ship-source pollution.

A number of MS (7 MS: DE, CY, FR, IT, LT, PL, RO) do not consider D8C3 in their monitoring programmes, and those who do could improve the consideration of frequent and minor spills, substances other than oil and land-based sources. There is lack of agreed methodological and agreed definition of "significant" in this context. Therefore, monitoring can be considered to be only partially sufficient to address the pressure by pollution events.

D9

As seen in Figure 73, most MS (BE, DK, EE, FI, FR, HR, NL, RO, SE, SI) indicate 'Pressures in the marine environment' as main monitoring purpose for D9. MS also indicate other purposes that should not be the main ones for this descriptor, mainly 'Environmental state and impacts' (EE, ES, IE, IT, LT, LV, PL, SE).

17 out of 18 MS (all but DE) address D9 in their monitoring programmes. The monitoring mainly consists of the control of the food chain based on risk assessment and executed in the frame of the EU Foodstuffs Regulation 1881/2006. This information can be overall considered to be sufficient to assess D9C1 and for following up the progress towards achieving GES. However, there is potential for improvement, in particular regarding the consideration of more contaminants since many additional chemical substances can be toxic, persistent and bioaccumulative in fish and other fishery products. Moreover, there is need to improve the traceability of the samples coming from Food programmes monitoring to be used for environmental assessments under D9.

D10

For D10, pressure mainly relates to criteria D10C1, D10C2 and D10C3. All the 18 MS reported on the monitoring purpose categories for criterion D10C1, but 15 MS (BE, DE, DK, EE, ES, FI, FR, HR, IE, IT, LV, NL, RO, SE, SI) reported 'Pressure in the marine environment' as monitoring purpose and 1 MS (CY) 'Human activities causing the pressures'. Overall, the monitoring of marine litter can be considered sufficient to assess D10C1 and progress towards GES. There is potential for improvement in considering further elements as determined in the GES Decision.

11 (DE, DK, EE, ES, FR, HR, IT, LV, NL, SE, SI) out of 18 MS reported monitoring purposes for criterion D10C2 under the category 'Pressure in the marine environment'. 1 MS (SI) reported only 'Pressures at source' and 'Pressures in the marine environment' in the same reporting cell. The feature category considered by all MS was 'PresEnvLitterMicro' for all monitoring programs of this criterion. 2 MS (FI, PL) reported only for the category 'Environmental state and impacts', which should not be considered to address pressures. Monitoring programs for marine microlitter are not considered for some MS. In addition, only 3 MS (IT, SE, SI) considered other elements than 'Artificial polymer materials' under the monitoring purpose 'Pressures in the marine environment'. Therefore, monitoring can be considered only partially covered to address pressures by microlitter.

Regarding D10C3, only 8 MS (BE, DE, DK, ES, HR, IT, NL, SI) reported 'Pressures in the marine environment' as monitoring purposes. Three categories of features were considered in the monitoring programs for D10C3 ('PresEnvLitter', 'PresEnvLitterMicro', 'PresEnvLitterSpp'). However, some MS considered only the elements 'amount in biota' or 'mass' of litter ingested, hindering the comparability between programmes. In this sense,

monitoring cannot be considered sufficient to address pressures by litter or microlitter ingested.

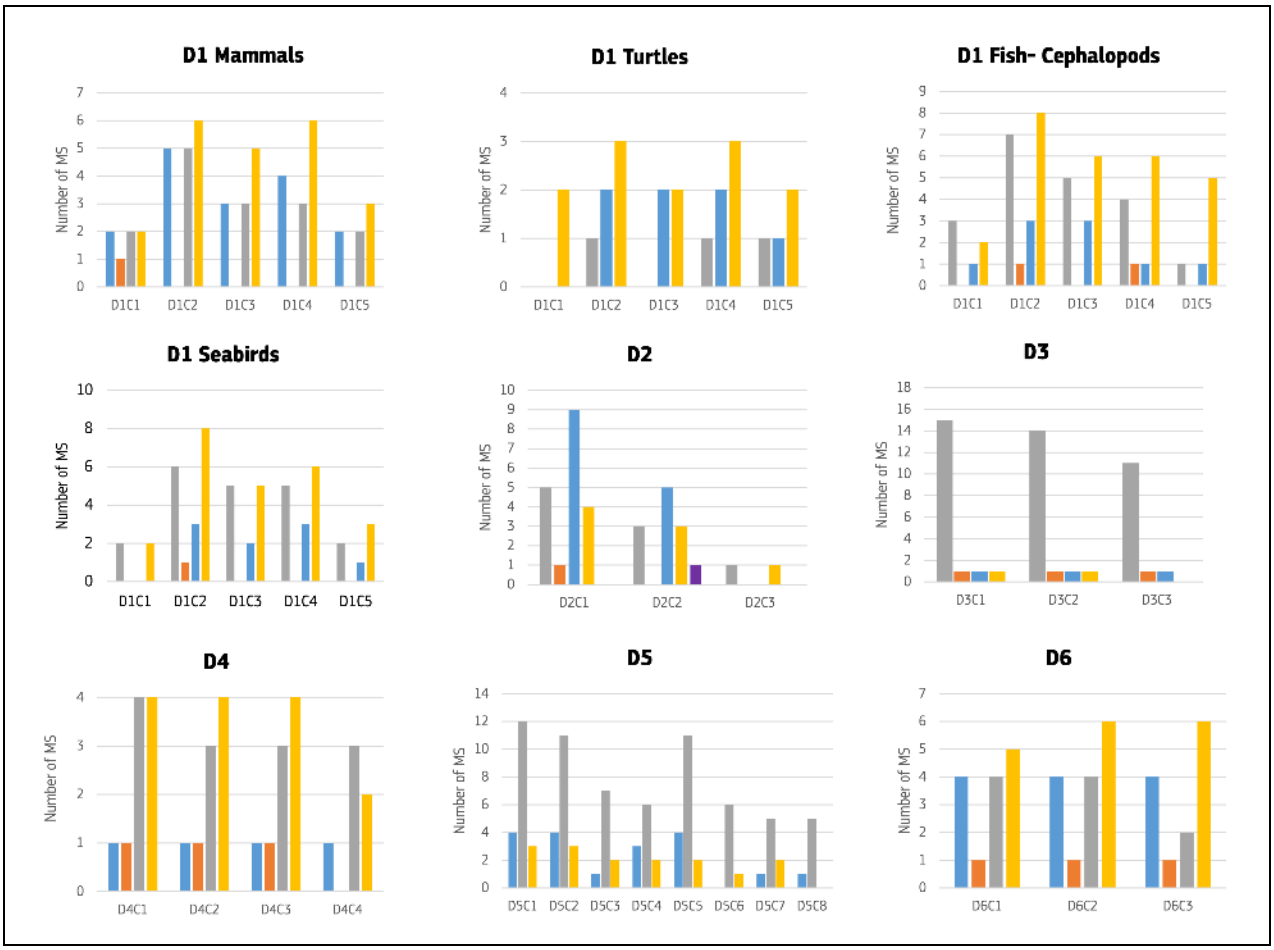
D11

Pressures and activities monitoring for D11 aims to collect data on the spatial and temporal distribution of the anthropogenic impulsive sound and low-frequency continuous noise by identifying the main activities producing marine noise and assessing the pressures at source and in general in the marine environment derived by impulsive and continuous noise. As shown in Figure 73, most MS indicated these purposes of monitoring when assessing both impulsive (17 out of 18 MS, with the exception of PL) and continuous sound (16 out of 18 MS, with the exception of PL and IE). Moreover, activity- and pressure-related features (other than 'PresEnvSoundImpulsive', 'PresEnvSoundContinuous', and 'PresInputSound') were also considered by the monitoring plans of 4 MS (DK, EE, ES and SE) with the purposes of identifying human activities causing the pressures and assessing the related pressures.

Overall, most MS addressed the assessment of pressures and/or activities within their monitoring plans; thus, according to the information provided at this stage, 16 out of the 18 MS reporting for D11 have in place sufficient monitoring to address Art 8 assessment of pressure at sea and pressure at source.

4.2.2 Links with Art. 9 (GES determination)

MSFD monitoring should be established in accordance with the criteria and methodological standards defined pursuant to Article 9(3) (i.e. those in the Commission Decision (EU) 2017/848). Moreover, MS should also base their assessments on those criteria that they said they would use under their MSFD Art. 9 reports. Figure 74 compiles the coverage of GES criteria as declared by MS under the reporting field 'Coverage_GEScriteria' (the timeframe for when sufficient monitoring was or will be in place to provide sufficient coverage, as indicated in the monitoring reporting guidance (MSFD Guidance Document 17)).



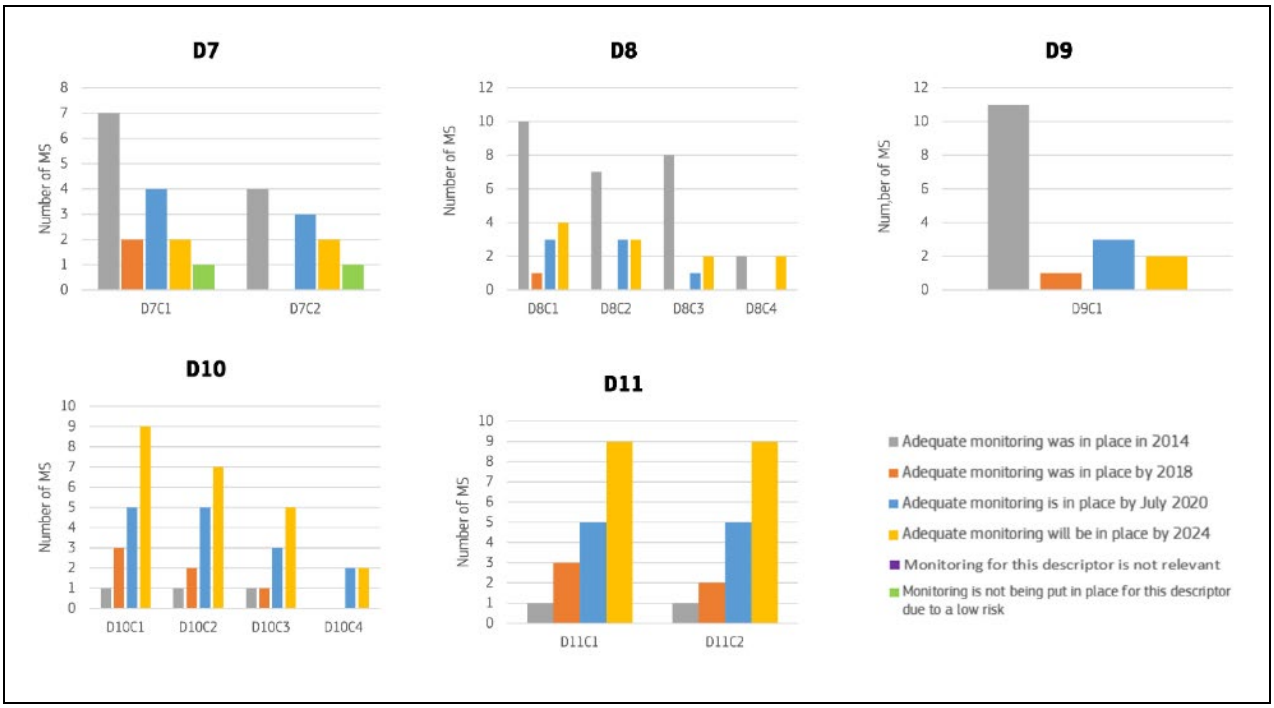


Figure 74. Number of MS declaring an adequate monitoring programme for GES criteria coverage

D2

Features 'PresEnvNISnew', 'PresBioIntroNIS' and 'PresBioIntroMicroPath' were reported in fourty monitoring programmes on D2C1, and five and three monitoring programmes for D2C2 and D2C3, respectively, by the 16 MS. The feature 'PresEnvNISestablished' (D2C2) was addressed in 28 monitoring programmes; for example ES, FR, and PL have four monitoring programmes in place for this criterion. Finally, for D2C3, two monitoring programmes address the feature 'PrevEnvAdvEffectsSppHab' (Figure 75).

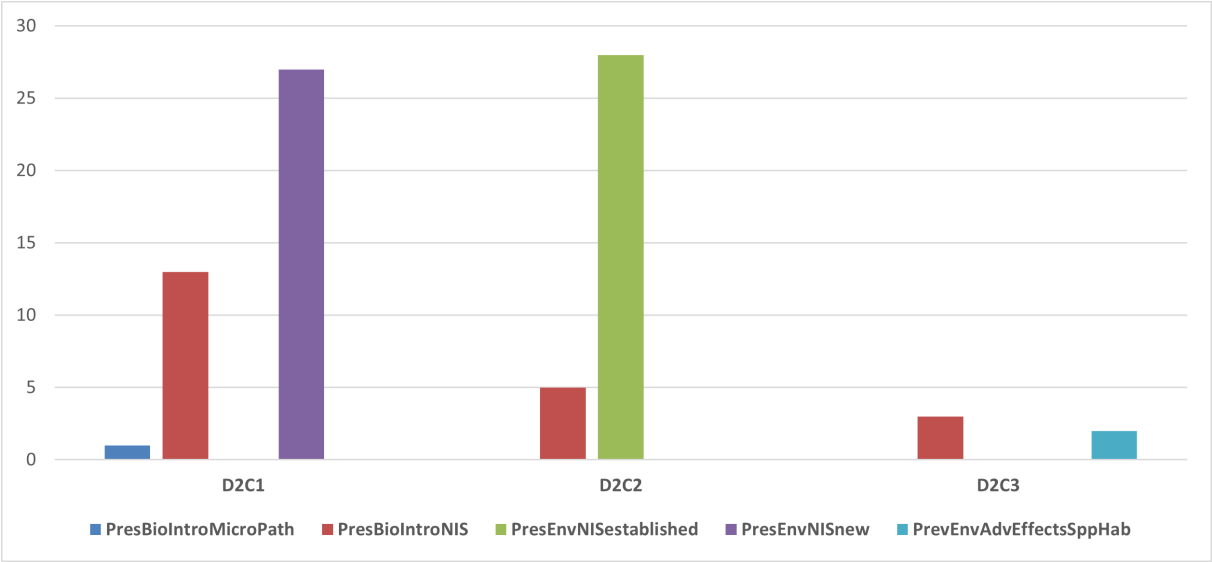


Figure 75. Number of monitoring programmes in place for each feature of the D2 criteria.

D3

The number of unique elements reported by each MS in different MSFD regions (Figure 3) indicates some problematic cases with inadequate coverage for Art. 9. There is the case of BE, where no species have been listed under 'Elements', just the generic term 'Demersal fish community', and then there are some cases of potential under-reporting (FR and HR) and over-reporting (DK and IE).

Unsurprisingly, owing to the long history of the monitoring programmes related to the CFP, all but 3 MS reported adequate monitoring in place in 2014 under the field 'Coverage_GEScriteria' (Figure 74). The split observed

along the different categories of coverage was similar for all three D3 criteria. CY and DK declared adequate monitoring by 2018 and 2020, respectively, for all D3 Criteria. However, FR reported that adequate monitoring will be in place by 2024 for D3C1 and D3C2, even if monitoring under the CFP should have been in place in 2014. Therefore, FR would need to correct their reported timeline for GES coverage.

D5

The feature 'PresEnvEutrophi' is the most represented and reported feature across the D5 criteria (135 elements). For other D5 criteria, the number of elements considered as well as that for other features is lower (Figure 76).

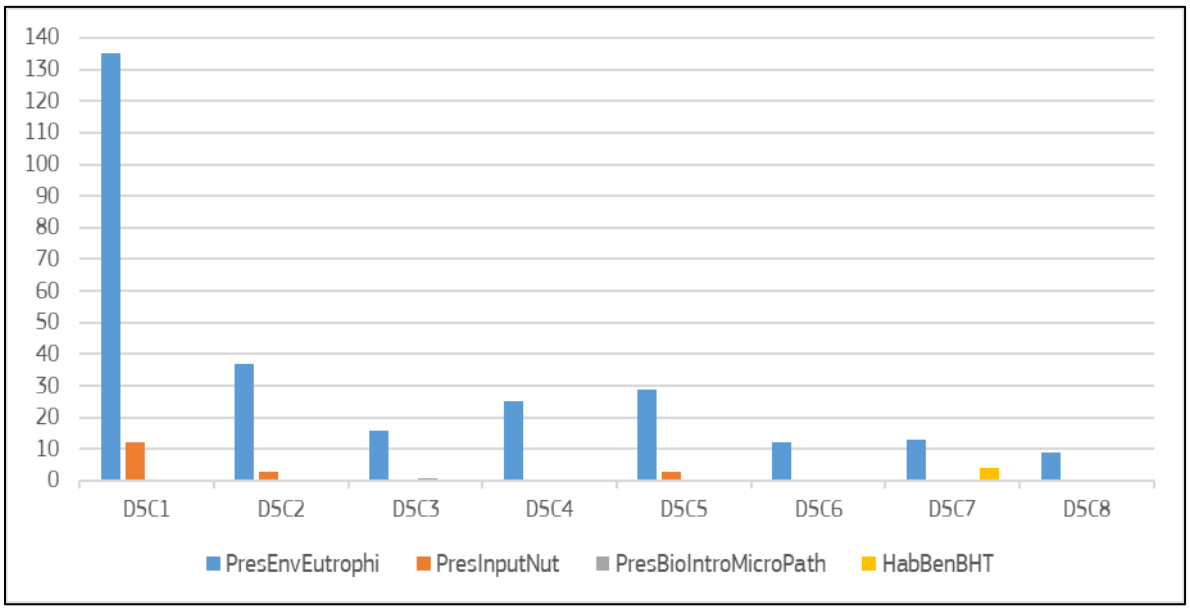


Figure 76. Number of elements per feature reported by MS for each criterion of D5.

D7

D7 monitoring is not consistent across MS and does not cover adequately the relevant criteria. Indeed, as mentioned above, D7C1 is monitored by 16 out of the 18 MS, while D7C2 is covered only by 9 MS. Similarly, one of the most relevant features for both criteria, 'PresEnvHydroChanges', is reported by 15 MS (BE, CY, DE, DK, EE, ES, FI, FR, HR, IE, IT, LT, NL, SE, SI), while 'HabBenBHT' and 'HabBenOther', relevant for D7C2, are reported by 9 (EE, FR, IE, LV, NL, PL, RO, SE, SI) and 3 MS (FR, LV, SE), respectively. The other features relevant for D7, such as 'CharaPhyHydro', 'CharaChem', or those related to relevant activities and pressures, are reported by a limited number of MS. Similarly, the elements that may be relevant for assessing hydrographic characteristics or benthonic habitats are not homogeneously reported, with only a few of them (e.g., salinity, current regime, temperature) reported by the majority of MS, and a large number of them reported by only 1 or 2 MS. Furthermore, the only parameter reported by the majority of MS is 'EXT'.

Despite the scattered coverage of the two criteria and relevant features, elements and parameters, 13 MS declared to have in place adequate monitoring for D7C1 (BE, DE, DK, EE, ES, FI, HR, IE, IT, LT, LV, SE, SI) and 7 did so for D7C2 (DK, EE, ES, FI, LV, SE, SI) (Figure 74). Only 3 MS declared that adequate monitoring will be in place in 2024 (CY and FR for D7C1, FR and RO for D7C2), and 1 MS that monitoring for this criterion is not in place due to a low risk (NL).

D8

As described above, all MS (18) address D8C1 in their monitoring programmes, while 14, 11, and 4 MS do so for D8C2, D8C3 and D8C4, respectively. Those MS have reported the adequacy of their monitoring programmes for GES criteria coverage (Figure 74). It can be seen that in most MS, adequate monitoring was already in place in 2014, 2018 or recently in 2020. Some MS have, however, reported that adequate monitoring will be in place only in 2024: CY, FR, LV, SE for D8C1, FR, LV and SE for D8C2, LV and SE for D8C3, and FR and SE for D8C4.

D9

As seen above, the contaminants monitored in relation to D9C1 are basically those for which a standard has been set under the Foodstuffs Regulation 1881/2006. 3 MS (FI, NL, PL) also report on few additional

contaminants, including some for which an EQS_{biota} is set under the WFD (e.g., PBDE and PFOS) and contaminants with no agreed threshold value in biota at EU level (like arsenic and organic pesticides).Only 1 MS (FR) considers the monitoring of phycotoxins and microbiological contamination under this descriptor. 1 MS (IT) reports only on one element 'all contaminants' and 1 MS (DE) does not report on D9 monitoring at all.

Most MS (15 MS) declare an adequate monitoring already in place in 2014, 2018 or recently in 2020, while 2 MS (CY and FR) will have adequate monitoring in 2024.

D10

MS have reported the adequacy of the monitoring programmes for GES criteria coverage in relation to D10, as shown in Figure 74. All MS analysed (18 MS), addressed D10C1 in their monitoring programmes, while 15, 10, and 4 MS considered D10C2, D10C3 and D10C4, respectively. Overall, MS have reported that adequate monitoring will be in place by 2024 for all criteria: BE, CY, DE, FR, IE ,LT, LV, NL, SE for D10C1; CY, DE, FR, LT, LV, NL, SE for D10C2; BE, CY, DE, FR, NL for D10C3; and DE, FR for D10C4. Only 1 MS (ES) declared that adequate monitoring was already in place in 2014 for D10C1, D10C2 and D10C3.

D11

Reporting covers adequately the relevant criteria and features for D11. As described above, all MS (18) address D11C1 in their monitoring programmes, while 17 MS (all but IE) do so for D11C2. As for D11C2 elements, not all of them are consistently covered among MS, with some variability on the frequency bands assessed across the different MS. Finally, the relevant parameters for the assessment of the relevant features are also covered by most MS. In addition to them, a series of other relevant parameters useful for the assessment of activity- and pressure-related features are also indicated.

However, only half MS declared to have in place adequate monitoring to cover GES criteria, while the other half of MS (CY, DE, FR, IT, LT, LV, NL, RO, SE) foresee that adequate monitoring will be in place by 2024 (Figure 74).

D1-Marine Mammals

Five MS (BE, DE, EE, FI, IE) reported to have adequate monitoring in 2014, although not always covering all criteria (for instance, D1C1 coverage is missing in DE, EE and IE). RO reported to have adequate monitoring in place in 2018, but only for the bycatch criterion. 5 MS (DK, ES, IT, LV, PL) reported to have adequate monitoring in place by July 2020, but once again not always covering all criteria (for instance, D1C1 coverage is missing in ES, IT and PL, and. Finally, 7 MS (CY, FR, HR, LT, NL, SE, SI) reported that adequate monitoring will be in place by 2024.

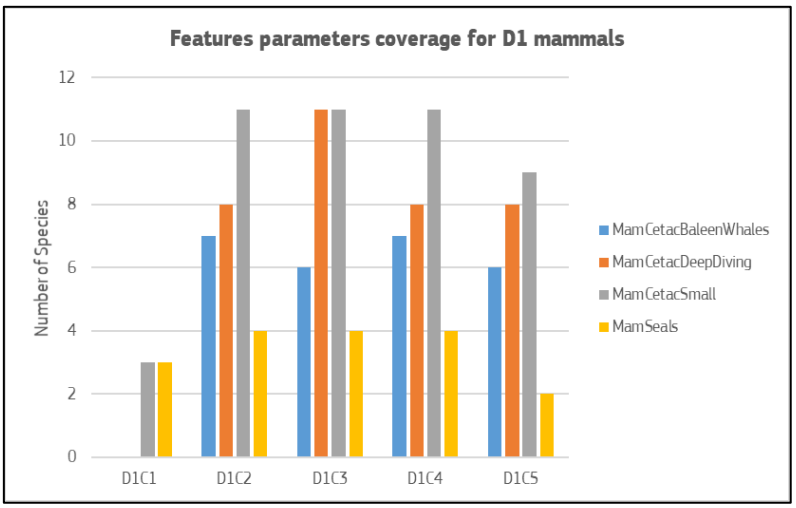


Figure 77. Number of marine mammal species reported per D1 criteria.

D1-Marine Reptiles

Figure 74 summarizes the information reported regarding the coverage of GES criteria for sea turtles. 1 MS (IE) reported having adequate monitoring in place in 2014 for D1C2, D1C4 and D1C5. 2 MS (ES, IT) reported having adequate monitoring in place by July 2020 for D1C2, D1C3 and D1C4 and 1 MS (IT) for D1C5. 4 MS (CY, FR, HR, IE) out of six MS reporting on marine turtles (CY, ES, FR, HR, IE, IT) reported that adequate monitoring will be in place only by 2024. Interestingly, IE has reported both that adequate monitoring was in place in 2014 and that

will be in place in 2024 for the same criteria D1C2, D1C4 and D1C5.

D1-Fish and Cephalopods

Figure 74 summarizes the information reported regarding the coverage of GES criteria for fish and cephalopods. Adequate monitoring in place in 2014 was reported by 3 MS (BE, EE, RO) for D1C1, 7 MS (BE, EE, ES, FI, IE, LV, RO) for D1C2, 5 MS (BE, EE, ES, FI, RO) for D1C3, 4 MS (EE, ES, FI, IE) for D1C4 and 1 MS (IE) for D1C5. Only 1 MS (LT) reported having adequate monitoring in place by 2018, but only for criteria D1C2 and D1C4. 4 MS (DK, ES, IT, PL) reported having adequate monitoring in place by July 2020. However, not all primary criteria are covered by IT and PL. 8 MS (CY, DE, FR, HR, IE, NL, SE, SI) reported that adequate monitoring will be in place only by 2024. Again, IE has reported both that adequate monitoring was in place in 2014 and that will be in place in 2024 for D1C2, D1C4 and D1C5.

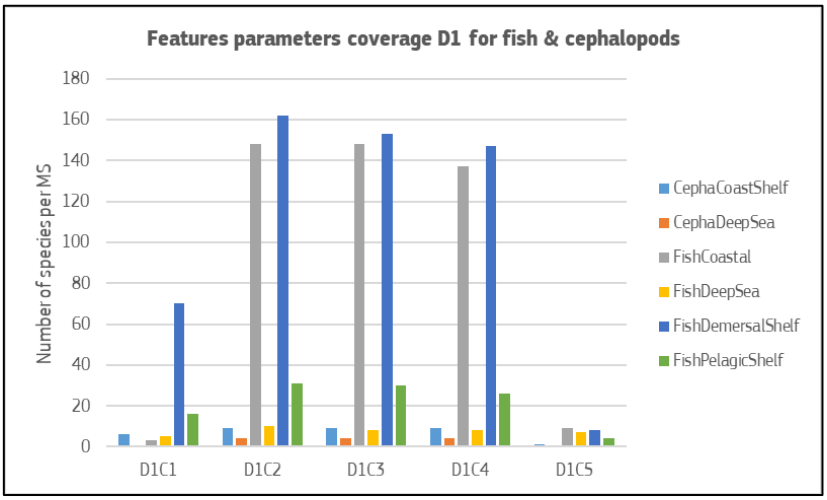


Figure 78. Number of fish and cephalopods species reported per D1 criteria.

D1-Seabirds

Figure 74 includes entries where the MS reported monitoring adequacy for all species and regions. It's indicative that only 4 (DE, FI, HR, SI) and 5 MS (DE, DK, HR, IE, SI) reported on criteria such as D1C1 and D1C5, respectively. The lack of information is not obvious in this case and should be cross checked with the reported gaps and plans.

Adequate monitoring in place in 2014 was reported by 2 MS (DE, FI) for D1C1 and D1C5, 6 MS (BE, DE, EE, FI, IE, PL) for D1C2, 5 MS (BE, DE, EE, FI, PL) for D1C3, and 5 MS (DE, EE, FI, IE, PL) for D1C4. Only 1 MS (LV) reported having adequate monitoring in place by 2018, but only for criterion D1C2. While the established monitoring programmes in this country seem adequate to assess population and mortality and are well coordinated at regional level, more criteria should be considered for an adequate GES assessment. 3 MS (DK, ES, IT) reported having adequate monitoring in place by July 2020, although not for all D1 criteria. Moreover, the risk for bycatches should be considered by IT for an adequate GES assessment. 8 MS (CY, FR, HR, IE, LT, NL, SE, SI) reported that adequate monitoring will be in place by 2024. Again, IE has reported both that adequate monitoring was in place in 2014 and that will be in place in 2024 for D1C2, D1C4 and D1C5.

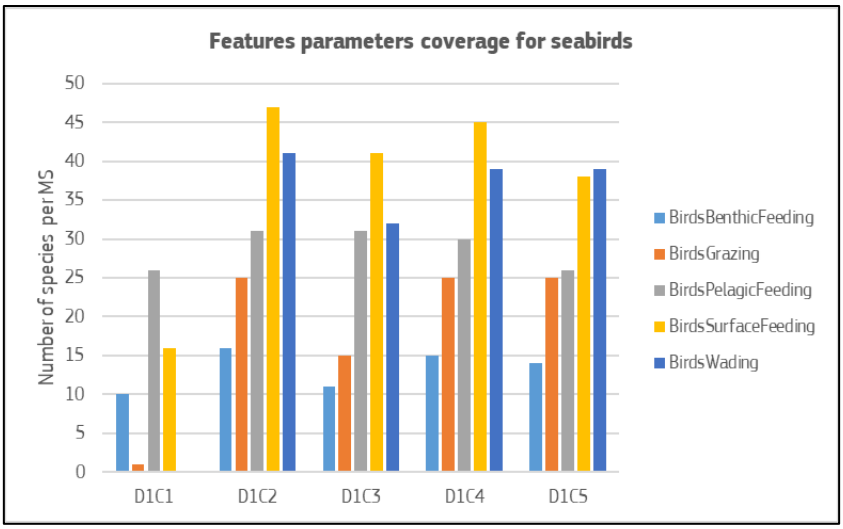


Figure 79. Number of seabird species reported per D1 criteria.

D1-Pelagic Habitats

One MS (FR) reported elements listed within the "Reference_List_Art11_v2.11" under the feature 'HabPelBHT' instead of the 'HabPelOther'. For 'HabPelBHT', 8 MS (EE, ES, FI, LT, LV, RO, SE, SI) have well reported on elements (i.e., variable salinity, coastal, shelf, oceanic/beyond shelf), of which 3 MS (FI, LT, SE) also provided detailed information on the broad habitats where monitoring of biotic and abiotic features occurs (e.g., FI monitoring covers coastal and shelf habitats). Few MS (RO, LV, SI), despite correctly reporting on the elements, did not include monitoring details or rationale to inform on human pressures, information on where (the broad habitat type) and how often the monitoring is carried out, or do not have monitoring in place yet. Finally, 2 MS (BE, DE) have misreported elements, using for example species group (i.e., phytoplankton communities) or indicators (i.e., Dia/Dino Index).

Only 3 MS (EE, ES, SE) indicated relevant parameters for the broad habitat types. For other pelagic habitats, none of the 6 MS (HR, EE, IT, NL, PL, SE) have correctly reported the monitoring elements, but indicated species groups or indicators. When looking at the monitoring strategy and description, MS have especially indicated collecting data on biological community's metrics (e.g., abundance, biomass), but with low sampling frequency.

D4

Among the D4 criteria, 4 over 5 features are reported by MS (Chemical characteristics were not reported). One feature was misreported under D4C4 ('PreBioDisturbSpp') by FI. Among a total of 45 elements defined for the descriptor, 37 elements were reported for D4C1, 39 for D4C2, 25 for D4C3 and 19 for D4C4. The element 'Apex predators' is the most monitored element with 10 parameters covering 3 features of D4 ('EcosysCoastal', 'EcosysOceanic', 'EcosysShelf').

D6

The MS do not report elements for D6C1 and D6C2. Numerous elements were reported for the two main features for the Broad Habitat Types (Annex I

Table A27 and Table A28).

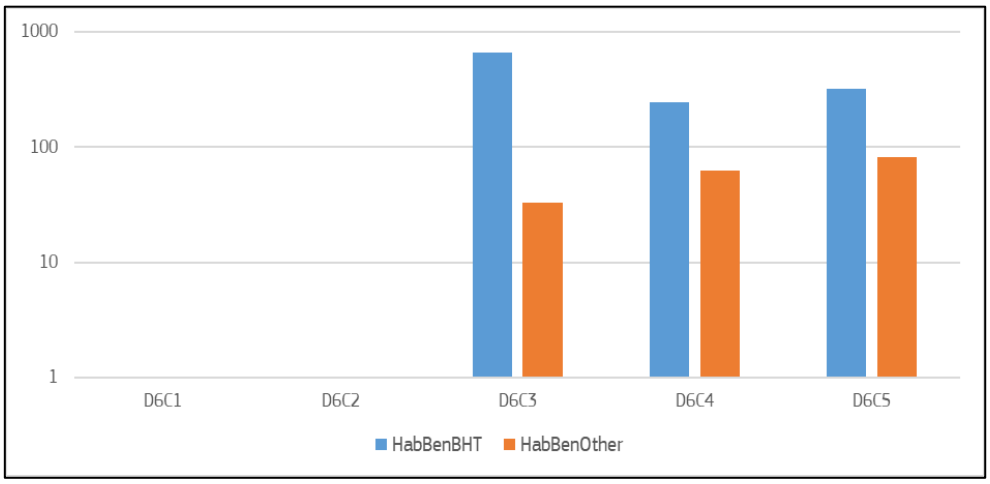


Figure 80. Number of elements for the two main features HaBeBHT and HabBenOther reported by MS for each D6 criterion.

There is a very good coverage of elements from the established monitoring programmes for D6C3-D6C5.

4.2.3 Links with Art. 10 (Targets)

The monitoring programmes should be able to generate information enabling the identification of indicators for environmental targets, and to evaluate progress towards achievement of the targets as well as of information allowing the assessment of the impact [effectiveness] of measures (Art. 13), in particular with respect to the achievement of environmental targets. The targets reported under MSFD Art. 10 have been found to be very variable and differently interpreted by MS[11]. Furthermore, under Art. 11 reporting, only the target codes appear, but not the target description, which makes it more difficult to analyse in-depth whether Art. 11 reporting provides sufficient data to assess progress with targets.

A summary of what MS have reported under the Art. 11 reporting field 'Coverage_Targets' (an indication of when sufficient monitoring was in place or by when sufficient coverage will be in place in relation to the targets addressed) is provided here as a way to analyse the links between Art. 11 and Art. 10 (Figure 81).

([11]) https://mcc.jrc.ec.europa.eu/main/dev.py?N=18&O=460

Figure 81. Number of MS declaring an adequate monitoring programme to assess progress with the selected targets.

D2

For D2C1, 14 MS (BE, DE, EE, ES, FI, FR, HR, IE, LT, LV, NL, PL, RO, SE) report targets for D2C1 under the Monitoring purpose 'pressure', and 6 MS included the rationale for targeting 'New NIS Introduction' into their monitoring strategy description.

When looking at the 'Programme Description' of the MS reporting on targets, 6 MS provided details on where, how often and coordination of the monitoring to progress on the target. Conversely, 6 MS provided more general overviews. The 52% of programmes across marine regions claim to have adequate monitoring in place by 2024 (Figure 81).

For D2C2, 8 MS (EE, ES, FR, IT, LT, LV, RO, SE) reported targets for D2C2 under the Monitoring purpose 'pressure', and 4 MS (FR, EE, ES, IT) have specific targets for 'Established NIS species'. In the monitoring programmes' descriptions, however, also LT and SE provided details on monitoring the abundance and distribution of NIS already established species groups (e.g., plankton, zooplankton) or invasive species (e.g., *Neogobius melanostomus, Eriocheir sinensis, Hemigrapsus sanguineus, Hemigrapsus takanoi*). RO has supplied very general description of monitoring strategy, programme and details, and reported as element only one species (*Mnemiopsis leidyi*). Only one target has monitoring in place since 2014 (Figure 81). CY did not report any target.

For D2C3, 3 MS (EE, LT, RO) reported targets under the monitoring purpose 'pressure'. However, in their programme's description there are some details on the monitoring rationale to collect data targeting habitats or species groups that are adversely affected by NIS.

D3

3 MS (DK, IE, SI) out of 18 have reported no targets under 'RelatedTargets', while 2 MS (DK, SI) have reported no target coverage under 'Coverage_Targets'. IE has reported adequate monitoring of targets without reporting any such targets. Of the 16 MS reporting monitoring of targets (all but DK and SI), 12 MS (BE, DE, EE, ES, IE, FI, HR, LT, LV, NL, RO, SE) and 11 MS (LV missing due to reporting a wrong 'Feature' - see 4.1.1) for D3C1 and D3C2, respectively, have indicated an adequate coverage of targets through the monitoring plans they have in place in 2014 (Figure 81). The split observed along the different categories of coverage was similar for all D3 criteria. For all three D3 criteria, CY has reported adequate coverage in 2018, while IT and PL have reported adequate coverage by 2020. Again, FR was the only MS reporting that adequate coverage will be in place by 2024, and only for D3C1 and D3C2.

D5

Many MS (BE, EE, FI, IE, IT, NL, RO, SE) reported that adequate monitoring was in place in 2014 for D5C1 and D5C2 and 7 MS (EE, FI, IE, IT, NL, RO, SE) for D5C5. Few MS (FR, LV for D5C1 and D5C2, and FR for D5C5) have reported that adequate monitoring will be in place by 2024.

D7

Information on the relevant targets for D7 has been provided by 14 MS (BE, DE, EE, ES, FI, FR, HR, IE, IT, LV, NL, PL, RO, SE). In some cases, the list of targets indicated included targets not strictly related to D7, but more generically related with impacts at sea (e.g., DE, ES). In some other cases, MS indicated administrative targets related with Marine Spatial Planning (MSP) or Environmental Impact Assessment (EIA) (e.g., NL, RO). In these cases, the description of the monitoring strategy indicated by MS could not provide sufficient detail to assess progress toward the targets. However, a number of MS also indicated targets referring to improving knowledge on hydrographical conditions, monitoring ocean variables and impacts (e.g., ES) and targets focused on limiting pressures associated with human activity or minimizing the extent of alterations (e.g., EE, IE, PL, SE). These targets are strictly related with monitoring programmes aimed to assess environmental states and impacts, or to those aimed to assess pressures, and thus, in these cases, the data provided are useful to assess progress with the targets.

Most MS in all marine regions indicated to have in place adequate monitoring for the assessment of D7C1 targets (BE, DE, EE, ES, FI, HR, IE, IT, LV, SE), while only 5 MS declared so for D7C2 (EE, ES, FI, LV, SE, Fig. 10). 3 MS declared that adequate monitoring will be in place in 2024 (FR and LT for D7C1, FR and RO for D7C2), and 1 MS that monitoring is not in place due to a low risk (NL).

D8

The number of targets varies widely among MS (from 1 to more than 40) and also the scope (from very general to very specific targets). Overall, MS in all marine regions have indicated an adequate coverage of their targets through the monitoring plans they have already in place, as shown in Figure 81. Only 3 MS do not have adequate

monitoring in place for any of the criteria they monitor, but they will in 2024 (DE, FR and LV for D8C1 and D8C2, LV for D8C3 and FR for D8C4). Moreover, 2 MS (CY and SI) have not reported the coverage of targets for any criteria.

D9

Overall, MS in all marine regions have indicated an adequate coverage of their targets through the monitoring plans they have in place, as shown in Figure 81. Only 1 MS (FR) will have adequate monitoring only in 2024 and 2 MS (CY and SI) have not reported the coverage of targets.

D10

Overall, 9 MS have indicated that the adequate coverage of their targets through their monitoring programmes is already in place (in 2014, 2018, 2020), as shown in Figure 81 (BE, DK, EE, ES, FI, HR IE, IT, PL, RO for D10C1, DK, EE, ES, FI, HR, IT, PL for D10C2, BE, DK, ES, HR, IT for D10C3, and EE for D10C4). In contrast, 7 MS will have adequate monitoring only in 2024 (CY, DE, FR, LT, LV, NL, SE for D10C1 and D10C2, CY, DE, FR, NL for D10C3, and DE, FR for D10C4). Only 1 MS (SI) have not reported the coverage of targets for any criteria.

D11

For D11, the description of the monitoring strategy indicated by most MS does not provide sufficient detail to assess progress toward targets. However, in most cases, monitoring programmes aimed to assess environmental state and impacts are strictly related with the targets referring to improving knowledge on underwater noise, compiling registers of noise or common database. On the other hand, monitoring programmes aimed to assess pressures are strictly related with the targets focused on limiting pressures related to the temporal and spatial occurrence of impulsive and continuous low-frequency sounds in the sea associated with human activity.

However, as shown in Figure 81 most MS (DE, EE, FR, IT, LT, LV, NL, SE) have not yet in place adequate monitoring to cover the relevant targets for D11 and 1 MS declared that monitoring for this descriptor is not relevant (RO), as no targets were indicated by this MS.

D1-Marine Reptiles

One MS (IE) reported having adequate monitoring in place in 2014 for criteria D1C2, D1C4 and D1C5. 2 MS (ES, IT) reported having adequate monitoring in place by July 2020 for criteria D1C2, D1C3, D1C4 and only one (IT) for D1C5. 4 out of six MS reported that adequate monitoring will be in place by 2024 (FR and HR for D1C1, HR and CY for D1C2 and D1C3, CY, HR, and IE for D1C4, and HR and IE for D1C5.

D1-Seabirds

LV reported to have adequate monitoring in place in 2018 only for the abundance criterion (D1C2). 3 MS (DK, ES, IT) reported to have adequate monitoring in place by July 2020. Finally, 6 MS (BE, DE, ES, EE, FL, PL) reported that adequate monitoring will be in place by 2024. There is a pattern between regions, where MED MS have recently established monitoring programs at regional level for seabirds compared to the BAL and NEA that have longer well-established monitoring programs.

D1-Pelagic Habitats

Only 2 MS (EE, SE) reported targets for D1C6 under the Monitoring purpose 'pressure', while the majority (13 MS) provided targets for the state/impact category. Among these, 5 MS (BE, FI, HR, PL, RO) included the rationale for targets under 'HabPelBHT' and 'HabPelOther', 3 MS (IT, SI, FR) did not specify their targets, and 7 MS (DE, EE, ES, LT, LV, NL, SE) had either not specific targets for pelagic habitats or only few details on how monitoring is progressing to assess the habitat state/impact or pressures. 3 MS (LV, NL, SE) have reported that adequate monitoring programmes will be in place in 2024. FR did not set targets because of the low risk related to pelagic habitat and SI did not report for the field 'Coverage_Targets'.

D4

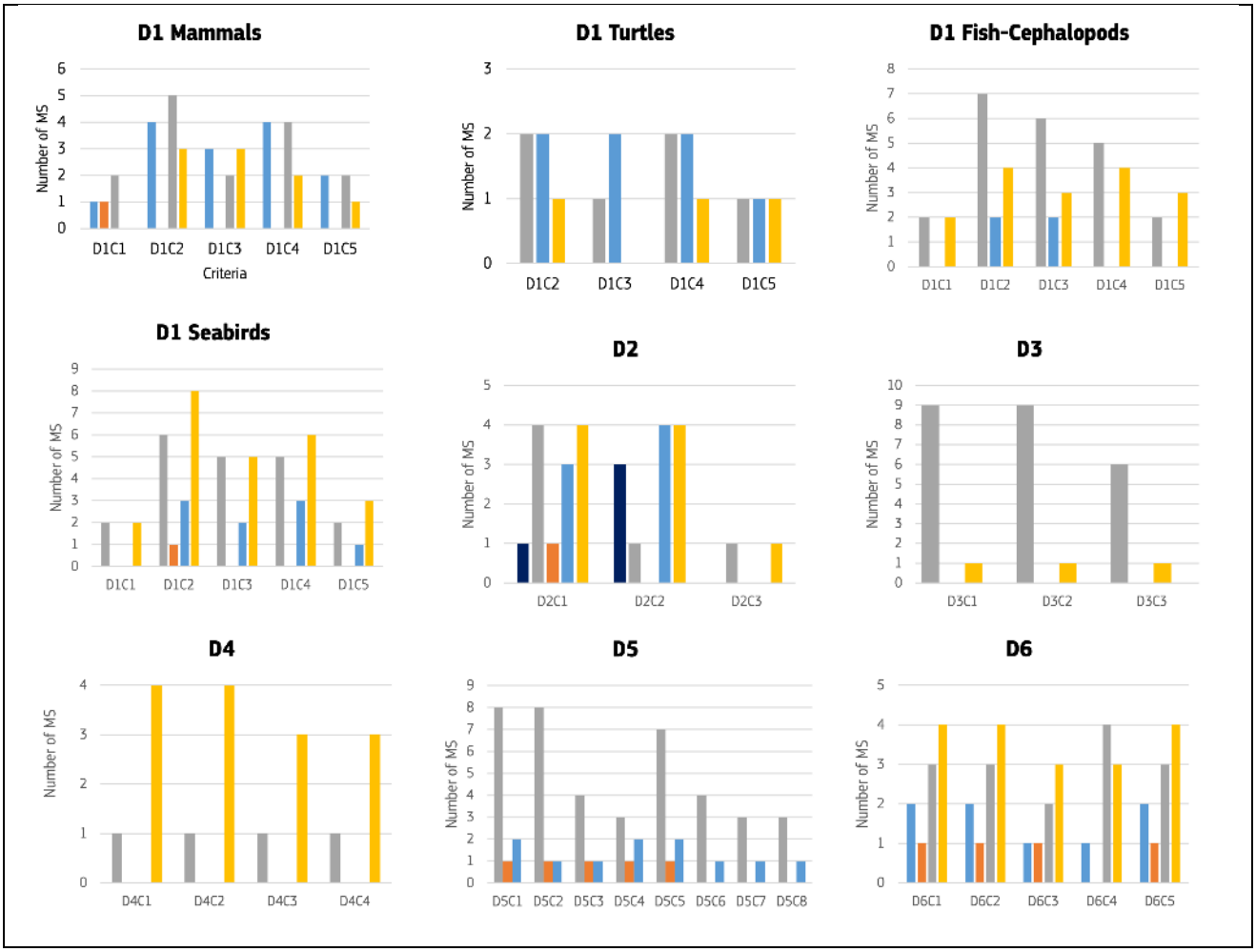
FI and HR reported an adequate monitoring in place since 2014 for all the descriptor criteria. ES, IT and SE reported that adequate monitoring will be in place by 2024 for D4C1 and D4C2, whereas ES, NL and SE did so for D4C3 and ES and SE also for D4C4.

4.2.4 Links with Art. 13 (Measures)

The monitoring programmes should be able to generate information allowing the assessment of the impact

[effectiveness] of measures (Article 13). According to the Commission's assessment report on monitoring programmes referring to the reporting of 2014[12], MS were advised to consider their programmes of measures when updating their monitoring programmes (Art. 17), so as to be able to measure their effectiveness in meeting the MSFD objectives. Furthermore, the Commission's Assessment on MS Programmes of Measures (PoM) referring to the reporting of PoMs in 2016[13], advised MS to better connect their measures with their monitoring programmes during the update phase, in order to evaluate their effects and hence efficiency and effectiveness in meeting targets and good environmental status.

As for targets, the measures proposed by MS are very variable. For the analysis of the links between Art. 11 and Art. 13, a summary of what MS have reported under the Art. 11 reporting field 'Coverage_Measures' (an indication of when sufficient monitoring was in place or when sufficient coverage will be in place in relation to the measures addressed) is provided (Figure 82). When timing/resources allowed to take a look at the measures description, the analysis delves a bit deeper into those links (e.g., for D8 and D9).



([12]) COM(2017) 3 final
([13]) COM(2018) 562 final

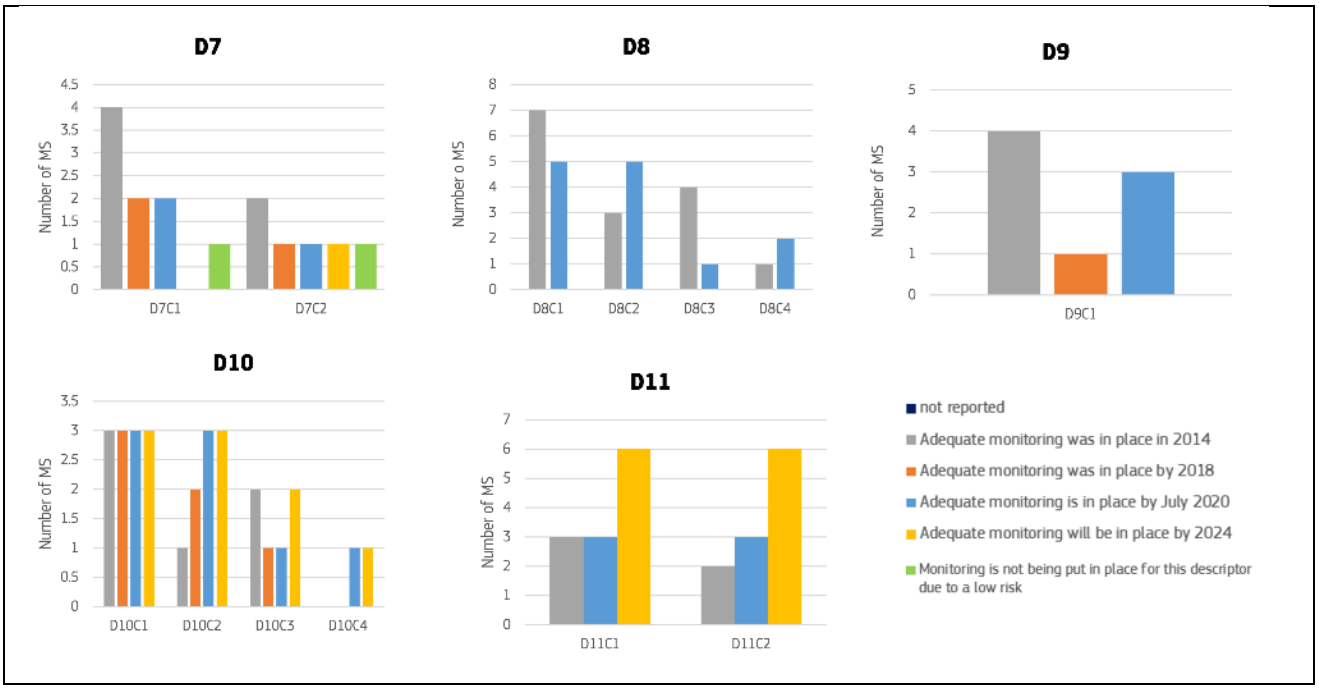


Figure 82. Number of MS declaring an adequate monitoring programme to assess progress with the measures.

D2

For D2C1, only 4 MS (DE, ES, NL, SE) indicated measures and 'Effectiveness of measures' as purpose of monitoring newly introduced NIS. NL and ES indicated that adequate monitoring has been in place since 2014 and 2020, respectively. Finally, DK reported that monitoring purpose but did not report on measures, while DE and SE did report on measures for future monitoring on 'Input or spread of non-indigenous species'.

For D2C2, 3 MS (ES, IT, SE) indicated 'Effectiveness of measures' for monitoring established NIS. ES and IT have monitoring in place since 2020 and SE will have it by 2024. DK did not report the measures. For D2C3, none of the MS reported on the monitoring purpose 'Effectiveness of measures'.

D3

8 MS out of 18 (CY, DK, FR, HR, LT, LV, PL, SI) have reported no measures under 'RelatedMeasures' and no relevant coverage under 'Coverage_Measures' for all three D3 criteria. Of the rest MS, all but IT have reported monitoring in place in 2014, while IT has reported monitoring in place by 2020 (Figure 82).

CY, DK, FR, HR, LT, LV, PL, SI have not reported on the timeline for measure coverage.

D5

Seven MS (DK, CY, HR, LT, LV, SI, FR) did not report measures under 'RelatedMeasures'. Many MS (BE, EE, FI, IE, IT, NL, RO, SE) have reported that adequate monitoring in place since 2014 for D5C1, D5C2, and/or D5C3. According to the information declared by MS, all MS have adequate monitoring in place at least by 2020 for most criteria.

D7

Overall, only 3 MS (EE, SE, ES) indicated 'Effectiveness of measures' as the purpose of monitoring either one of the relevant features listed for D7 (Figure 73). However, the monitoring strategy description provided by some MS also included as objective the assessment of measures related to the achievement and/or maintenance of GES and their effectiveness (e.g., DK, IE, NL, SI). 8 MS (CY, DK, FR, HR, LT, LV, PL, SI) did not indicate any measure for this descriptor, and, similarly to the target reporting, some MS often indicated vague measures that are not strictly related with D7. In other cases, the measures indicated were generic administrative measures related with MSP, integrated coastal zone management, or EIA procedures, but not focused on reducing pressures or restoring species and/or habitats. Thus, the information reported by MS is often not enough to assess progress towards the measures. As shown in Figure 82, only half MS have in place adequate monitoring to assess the effectiveness of the relevant measures for D7C1 (BE, DE, EE, ES, FI, IE, IT, SE) and 4 MS have in place adequate

monitoring to assess the effectiveness of the relevant measures for D7C2 (EE, ES, FI, SE). 1 MS declared that adequate monitoring will be in place in 2024 for D7C2 (RO), and 1 MS that monitoring is not in place due to a low risk (NL).

D8

Overall, MS in all marine regions have indicated an adequate coverage of their measures through the monitoring they have already in place (in 2014 or 2020), as shown in Figure 82. Nevertheless, many MS do not report the coverage of measures for any criteria (CY, FR, HR, LT, LV, and SI for D8C1, FR, HR and LV for D8C2, HR, LV and SI for D8C3 and FR for D8C4).

'Effectiveness of measures' is reported as monitoring purpose by 8 MS (BE, DE, EE, ES, IE, IT, NL, SE) for D8C1, 3 MS (BE, ES, SE) for D8C2, 3 MS (BE, EE, LV) for D8C3 and 2 MS (EE, SE) for D8C4 (Figure 82).

As for targets, the number of measures reported under Art. 11 vary from 1 (e.g., FI and LV) to several different measures (e.g., DE, IE and ES). The type of measures is also very variable, from specific (e.g., BE refers to the ban on shipping (including fisheries) within the wind farm areas and on the use of TBT and DE refers to the expansion of wastewater treatment plants) to very general (e.g., DE refers to the prevention against the negative effects of pollution from populated areas, EE to the limitation of emissions of hazardous substances and IT to rebalancing the relationship between agriculture and the environment). Several MS (BE, DE, ES, IE, IT, NL, SE) also refer to the measures within other EU directives, namely the WFD, and within RSC. In many cases, the operational targets are related to specific measures that facilitate the achievement of the rest of the targets, but address issues that cannot be measurable through the samplings, censuses and campaigns that are part of the thematic monitoring programmes (e.g., handling with old munitions in the sea, awareness and training of best practices in maritime and coastal activities, management of pollution events, or preparation of guidelines for land-sea discharges). Moreover, 7 MS (CY, DK, FR, HR, LT, LV, SI) do not report any measure. Thus, the information reported by MS under Art. 11 is not enough detailed to assess progress towards the measures.

D9

'Effectiveness of measures' is reported as monitoring purpose by 6 MS (BE, EE, ES, IE, IT, SE) (Figure 82 above).

More than half of the MS reporting on D9 (CY, ES, FR, HR, LT, LV, PL, RO, SI) do not report the coverage of measures for this descriptor. The other 8 MS (BE, DK, EE, FI, IE, IT, NL, SE) have indicated an adequate coverage through the monitoring they have already in place (in 2014, 2018 or 2020) (Figure 82). However, DK indicates the measures coverage, but do not report any measure under Art. 11.

EE reports the same measures as for D8 (which are not directly linked to contaminants in fish and seafood for human consumption) and FI indicate three measures related to the regulation of Persistent Organic Pollutants (POPs). BE, IE and SE also report many measures common with D8, but BE and IE incorporate some specifically linked to D9, namely to the application of legislation on fish and seafood. NL indicates only one measure, which also refers to the regulation of pollutants in fish and fish products. IT reports several measures linked to food safety (e.g., the control of hormonal substances, pharmacological additives and disinfectants in aquaculture farms).

As only 4 MS report measures directly linked to D9, while many other MS do not indicate their measures or measure coverage, the information reported under Art. 11 is, overall, not enough to assess progress towards the measures.

D10

Twelve out of 18 MS have indicated that the adequate coverage of their measures through their monitoring programmes is already in place (in 2014, 2018, 2020), as shown in Figure 82 (BE, DK, EE, ES, FI, HR IE, IT, PL, RO for D10C1, DK, EE, ES, FI, HR, IT, PL for D10C2, BE, DK, ES, HR, IT for D10C3, and EE for D10C4). DK indicated measures coverage, but did not report any measure under 'RelatedMeasures' field. Moreover, some of the measures reported by MS were sometimes not related to D10 (e.g., IE reported measures for other MSFD descriptors in the same reporting cell, such as "ACSIE-M151 - 'Progressively implement the OSPAR Offshore Oil and Gas Industry Strategy').

Overall, only 8 MS (DE, EE, ES, IE, IT, LV, NL, SE) have reported 'Effectiveness of measures' as monitoring purpose (Figure 82) and 11 MS (BE, DE, EE, ES, FI, IE, IT, NL, PL, RO, SE) indicated measures linked to D10, although, sometimes, reported along with other measures linked to other descriptors. In this sense, the information provided under Art. 11 is currently not enough to assess the progress with measures.

D11

As shown in Figure 73, only 3 MS (DE, EE, ES) indicated 'Effectiveness of measures' as purpose of monitoring either for impulsive, continuous sound or activity-/pressure- related features. However, the monitoring strategy description provided by some MS also included the assessment of measures related to the achievement and/or maintenance of GES (e.g., DK, NL, SI). In some cases, measures are strictly related with, if not the same as, the target indicated. Thus, also in this case, the information reported by MS is not enough to assess progress towards the measures, and, as shown in Figure 82, 6 MS (DE, EE, IT, NL, RO, SE) have not yet in place adequate monitoring to assess the effectiveness of the relevant measures. Indeed, only 3 MS (DK, ES, PL) declared to have in place adequate monitoring for both D11 criteria since July 2020, while BE and FI declared to have in place adequate monitoring for both criteria since 2018, and IE to have them in place since 2018 only for D11C1.

D1-Marine Reptiles

2 (FR, HR) out of 6 MS (CY, ES, FR, HR, IE. IT) did not report any adequacy for the coverage of measures. 1 MS (IE) reported having adequate monitoring in place in 2014 for D1C2, D1C4 and D1C5. 2 MS (ES, IT) reported having adequate monitoring in place by July 2020 for D1C2, D1C3, D1C4, and only one (IT) for D1C5. 1 MS (IE) reported that adequate monitoring will be in place by 2024 for D1C1, D1C4 and D1C5.

D1-Seabirds

Six MS (BE, DE, EE, ES, FI, PL) reported to have adequate monitoring in 2014. 4 MS (CY, HR, LT, NL) reported that adequate monitoring will be in place by 2024 (Figure 82).

D1-Pelagic Habitats

8 MS (FR, HR, LT, LV, NL, PL, RO, SI) out of 15 (BE, DE, EE, ES, FI, FR, HR, IT, LT, LV, NL, PL, RO, SE, SI) did not reported any measure under 'RelatedMeasures'. The reported information on measures provided by ES was unclear and generally oriented to promote the conservation and restoration of species and habitats, and to increase the available knowledge on pelagic habitats. 6 MS (BE, DE, EE, FI, IT, SE) reported for pressure reduction-oriented measures, whereas 1 MS (DE) reported measures for the active restoration. DE reported a total of 87 measures, while IT reported 39 measures, EE reported four measures, SE three measures, and FI and BE only one.

D4

FI is the only MS declaring an adequate monitoring in place since 2014, whereas the other MS reported that adequate monitoring will be in place by 2024 (EE, ES, IT, SE for D4C1 and D4C2, ES, NL, SE for D4C3, and ES, EE, SE for D4C4).

D6

Most MS have reported that adequate monitoring will be in place by 2024 for all the criteria.

4.2.5 Data accessibility

Most MS have provided access to the monitoring programs via data links for all descriptors. However, those links do not always work properly and direct access to data selection and downloading is not always available. In some cases, the links lead to institutional homepages or overview webpages of national or other Directive's monitoring programmes, which do not allow to access to specific datasets. In other cases, the links cannot be accessed as requiring credentials, or do not exist and cannot be found. Also, often web links lead to pdf documents or pages written in languages other than English, with no option to view the English version. For D9, for instance, 25 unique web links have been reported in total, of which 40% lead directly to a dataset, while other 40% lead to a generic webpage or pdf, 16% lead to an error on the website, and 4% require credentials to login. For D8, 72 different links are provided, of which only 33% lead directly to a dataset.

The accessibility to monitoring data from the links provided in the Art. 11 reporting field 'DataAccess' for different Descriptors is summarized in Figure 83, according to the following criteria:

- Yes, can access (i.e., the link leads directly to a dataset)
- Link not accessible (e.g., credentials are needed to login and access it)
- Not linked to a specific dataset (e.g., the link leads to a generic webpage, a pdf report or pages written in languages other than English, with no option to view the English version)
- No (e.g., the link leads to an error or page not found)
- Not reported (i.e., no link is provided)

The number of links varies highly among MS (Figure 84). For instance, for D8, DE provides 17 different links and FI 15, while many other MS provide only one link. Moreover, those multiple web links are often entered in the same reporting cell (separated by commas), thus hindering one-click access.

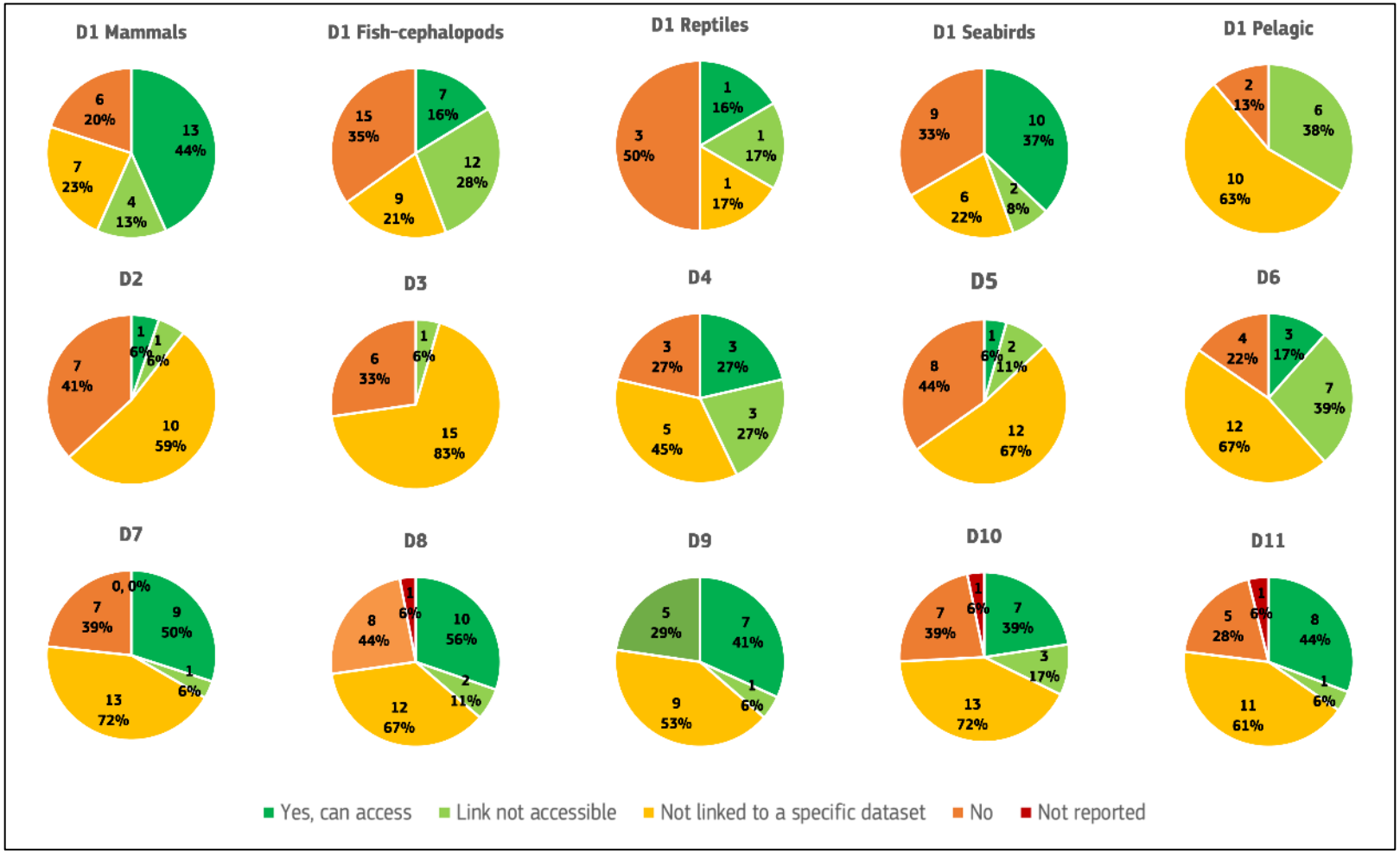


Figure 83. Number and % of MS whose data are accessible through the links provided under Art. 11 reporting.

Figure 84. Number of links of each category reported per MS.

4.3 Monitoring methods used in the region

The monitoring programmes shall be compatible within marine (sub)regions and with monitoring laid down by Union legislation and under international agreements (e.g., RSC). The monitoring methods reported by MS are summarized here to provide insights on whether they are consistent across the marine region so as to facilitate comparability of monitoring results. The corresponding method codes (MonitoringMethod_Enum) are listed in the monitoring reporting guidance (MSFD Guidance Document 17). Moreover, for some descriptors, a summary of the types of monitoring (in-situ, remote sensing, etc.) as reported by MS is also provided.

D2

All 18 MS analysed (BE, CY, DE, DK, EE, ES, FI, FR, HR, IT, IE, LT, LV, PL, NL, RO, SE, SI) reported on the D2 criteria and provided information on the applied monitoring methods. The methods are mostly agreed under RSC (Table 64). 15 MS also indicated other ('OTH') methods, but no further explanations were provided.

Table 64. Number of monitoring methods reported by MS for D2 per marine region (Barcelona Convention (BC); HELCOM (HEL); OSPAR (OSP); Other (OTH); Water Framework Directive (WFD); Common Fishery Policy (CFP)).

	MS	BC	HEL	OSP	OTH	WFD	CFP
BAL	DE		2				
	FI		6		2		
	EE		6	2	4		
	LT		3				
	LV						
	SE		3	1	4		
	DK				2		
	PL				1		1
BLK	RO				3		
MED	FR				2		
	HR						
	IT				1		
	SI				1		
	ES	2		2		2	
	CY						
NEA	DE			1			
	IE				1		
	NL			1	1		
	FR				1		
	BE				1		
	ES	2		2		2	
	DK				2		
	SE		3	1	4		

D3

MS reported from one to nine monitoring methods under 'MonitoringMethods'. 'CFP' methods have been declared by the majority of MS in all regions (11 MS in total: DE, LV, PL, SE, CY, FR, HR, IT, ES, IE, NL), followed by 'HELCOM methods, reported by 3 Baltic MS (EE, LV, SE) (Table 65). 14 MS (DE, DK, EE, FI, LT, SE, RO, FR, HR, IT, SI, BE, ES, NL) reported also other methods ('OTH'); notably, for 5 MS (BE, CY, DK, LV, PL) 'OTH' was the only monitoring method reported. Other categories reported included 'NFC (FR, IE), 'OSP' (IE) and 'ICCAT' (FR).

These findings suggest that there is need for harmonisation across MS in the reported/executed monitoring methods. In particular, the high number of 'OTH' methods reported by MS complicates the assessment of the consistency of the monitoring methods.

Table 65. Number of monitoring methods reported by MS for D3 per criteria and marine region (CFP: Common Fisheries Policy (CFP); HELCOM (HEL); International Commission for the Conservation of Atlantic Tunas (ICCAT); North East Atlantic Fisheries Commission (NFC); OSPAR (OSP); Other (OTH)).*MS that have reported on combined regions (BAL/NEA or NEA/MED).

	MS	CFP			HEL			ICCAT			NFC			OSP			OTH		
		D3C1	D3C2	D3C3	D3C1	D3C2	D3C3	D3C1	D3C2	D3C3	D3C1	D3C2	D3C3	D3C1	D3C2	D3C3	D3C1	D3C2	D3C3
BAL	DE	2	2	2													1	1	1
	DK*																1	1	1
	EE				1	1	1										1	1	1
	FI																1	1	1
	LT																1	1	1
	LV	2			2														
	PL	1	1	1															
	SE*	1	1	1		1	1										1	1	1
BLK	RO																1	1	1
MED	CY	1	1	1															
	FR		2						1		2						1	1	
	HR	1	1	1													1	1	1
	IT	1	1	1													1		
	SI																1	1	1
	ES*	6	6														1	1	
NEA	BE																1	1	1
	DE	2	2	2													1	1	1
	DK*																1	1	1
	ES*	6	6														1	1	
	FR		4								2						1	1	
	IE	5	5								2	2		1	1				
	NL	5	2															1	
	SE*	1	1	1													1	1	1

D5

18 MS reported on D5 criteria and provided information on the applied monitoring methods (Table 66). The number of reported agreed methods at HELCOM level were 18, whereas at OSPAR level 8 methods were reported. RO reported in the BLK the method HEL-32, which refers to the COMBINE Programme under HELCOM.

Table 66. Number of monitoring methods reported by MS for D5 per marine region (Barcelona Convention (BC); HELCOM (HEL); OSPAR (OSP); Other (OTH); Water Framework Directive (WFD); Common Wadden Sea (CWS)).

	MS	BC	CWS	HEL	OSP	OTH	WFD
BAL	DE	0	1	10	0	3	1
	DK	0	0	1	0	2	0
	EE	0	0	11	1	3	0
	FI	0	0	2	0	1	0
	LT	0	0	3	0	0	0
	LV	0	0	12	0	1	0
	PL	0	0	4	0	0	0
	SE	0	0	11	0	2	0
BLK	RO	0	0	1	0	1	0
MED	CY	1	0	0	0	0	1
	ES	3	0	0	0	1	0
	FR	1	0	0	5	0	3
	HR	0	0	0	0	1	1
	IT	0	0	0	0	1	0
	SI	0	0	0	0	1	0
NEA	BE	0	0	0	0	1	0
	DE	0	1	0	5	3	1
	DK	0	0	0	0	2	0
	ES	3	0	0	0	1	0
	FR	1	0	0	5	0	3
	IE	0	0	0	1	1	1
	NL	0	0	0	4	2	2
	SE	0	0	0	4	2	0

D7

MS indicated both the use of monitoring methods agreed either at EU or regional level, and the use of other methods, which in several cases were national long-term monitoring programmes. The methods agreed at EU level included those produced within the WFD (WFD-007 and WFD-008), while those agreed at regional level included mainly HELCOM (HEL-008, for salinity and temperature, HEL-010 and HEL-011, for measuring Secchi depth and turbidity, HEL-028, for coastal fish monitoring, and HEL-032, manual for monitoring in COMBINE programme) and OSPAR methods (OSP-16, for sound sources monitoring, OSP-20 and OSP-21 for oxygen and nutrients monitoring), as well as the North-Eastern Atlantic Fisheries Commission method (NFC-002, vessel monitoring system).

Among the 18 MS reporting for D7, 2 MS (ES, FR) referred to the methods listed within the WFD, 3 MS (ES, FR, IE) to agreed methods at OSPAR, 1 MS (SE) to the NFC, and 4 MS (EE, ES, LT, SE) to HELCOM agreed methods (Table 67). MS that did not distinguish among their marine regions (i.e., DK, ES, SE) indicated both HELCOM and OSPAR methods, which were assigned according to the relative marine region. However, ES reported also the use of HEL agreed methods, even though this MS does not belong to the BAL marine region.

Within each region, some level of use of non-agreed methods was reported by the majority of MS. In particular, in the BLK region, only 'OTH' was indicated, and the large

majority of MS indicated that “other” methods were used in addition to those agreed at EU or regional level.

Table 67. Number of monitoring methods reported by MS for D7 per criteria and marine region (North East Atlantic Fisheries Commission (NFC); Water Framework Directive (WFD); HELCOM (HEL); OSPAR (OSP)).

	MS	**OTH**		**WFD**		**HEL**		**OSP**	
		D7C1	D7C2	D7C1	D7C2	D7C1	D7C2	D7C1	D7C2
BAL	DE	1							
	DK	1	1						
	EE	1	1				1		
	FI	1	1						
	LT					1			
	LV	1	1						
	PL								
	SE	1	1			3			1 (NFC)
BLK	RO		1						
MED	CY	1							
	ES			1	1	2	2	2	2
	HR	1							
	FR	1	1					1	1
	IT	1							
	SI	1	1						
NEA	BE	1							
	DE	1							
	DK	1	1						
	ES			1	1	2	2	2	2
	FR	1	1					1	1
	IE	1		1				1	
	NL	1	1						
	SE	1	1			3			1 (NFC)

The types of monitoring applied for features, elements and/or parameters listed under D7C1 and D7C2 are shown in Figure 85. The types of monitoring are highly variable across regions, although, the majority of MS indicated in-situ sampling coastal, in-situ sampling offshore, numerical modelling and administrative data collection as the most frequently used. In addition, remote satellite imagery and remote surveillance were also indicated as relevant methods for D7C1 monitoring.

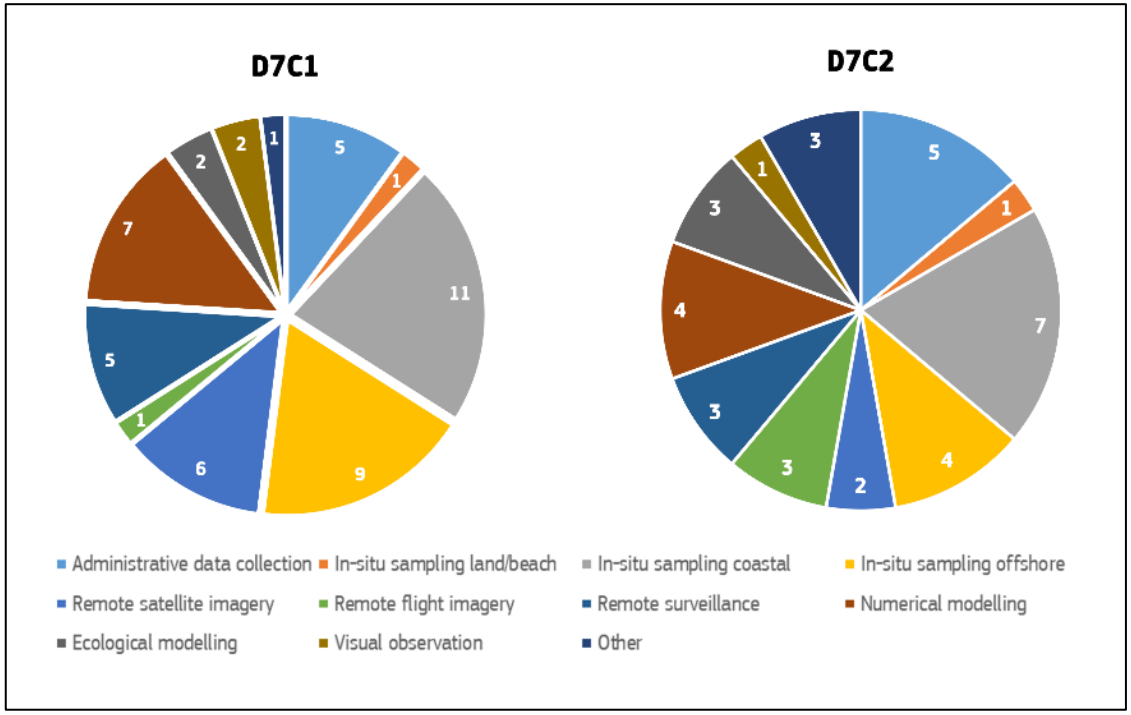


Figure 85. Number of MS using the different monitoring types for D7 criteria.

D8

MS have indicated the use of monitoring methods agreed either at EU or regional levels, and the use of other methods, which in several cases refer to national monitoring programmes. The methods agreed at EU level included those produced within the WFD (WFD-019, WFD-025, WFD-032, WFD-033), while those agreed at regional level included HELCOM (HEL-001, HEL-002, HEL-003, HEL-005, HEL-006, HEL-007, HEL-014, HEL-031, HEL-032, HEL-034, HEL-036), OSPAR (OSP-001, OSP-018, OSP-25, OSP-26, OPS-28, OSP-29), and Barcelona Convention (BC-001) methods (method codes from list 'MonitoringMethod_Enum' in the MSFD Guidance Document 17).

In relation to D8C1, many MS refer to the WFD methods, although those methods are not reported by a number of countries in each region (FI, LT, LV and PL in the Baltic, ES, FR, IT and SI in the Mediterranean, and BE, ES and FR in the Atlantic). The methods agreed within OSPAR and HELCOM are also normally considered by MS in those regions, although there are some differences in the number of methods considered by MS. Moreover, 3 MS in the Mediterranean (HR, IT, SI) do not make reference to the methods agreed within the Barcelona Convention (Table 68).

For D8C1, the majority of MS (10 MS) have indicated 'other' methods in addition to those regionally agreed at EU or regional level. For instance, BE refers to the methods for collecting sediment, water and biota samples for monitoring different contaminants, the OSPAR Agreement 2005-8 for monitoring radionuclides and the OSPAR methodology for EcoQO. DE refers to the methods for air pollution monitoring (within the European Monitoring and Evaluation Programme (EMEP) and the United Nations

Economic Commission for Europe (UNECE)) and the national ordinance on the protection of surface water. EE indicates the EURATOM Treaty concerning the monitoring of radionuclides and national regulation for environmental monitoring of contaminants. The monitoring of radionuclides is also indicated by SE. National monitoring guidelines are also indicated by FI, IE RO and SI. Some MS (DK, IT, SE) provide links to national reports, without specifying the methods, which are written in their national languages. Interestingly, NL writes 'What must be entered here' under the reporting field 'MonitoringMethodOther'.

For D8C2, a number of MS in the Baltic do not refer to any HELCOM method (EE, FI, LT, LV, PL) and in the Mediterranean, only ES refers to the Barcelona Convention for this criterion. 7 MS indicate 'other' methods: BE mentions again the OSPAR EcoQO standards, EE refers to the experience of monitoring of breeding birds on small maritime islands, and HR indicates national thresholds for a number of biological-effects methods (indeed, this country reports more methods here than in the 'parameter' field). DK, IT and SE provide again links to national reports, and PL refers to the HELCOM guidelines for monitoring white-tailed eagles.

More harmonisation exists in relation to D8C3, for which MS in OSPAR (BE, IE, NL, SE) refer to the Bonn Agreement methods (although FR reports the Bonn Agreement for D8C4 instead) and MS in HELCOM to the method HEL-031. National methods are also reported by EE, ES, HR and SI.

RO only reports on D8C1 and there are no regional methods agreed in the Black Sea.

Table 68. Number of monitoring methods reported by MS for D8 per criteria and marine region (Water Framework directive (WFD); HELCOM (HEL); Barcelona Convention (BC); OSPAR (OSP); Bonn Agreement (BON) methods from list 'MonitoringMethod_Enum' in the MSFD Guidance Document 17).

	MS	**Other**				**WFD**				**HEL**				**BC**				**OSP**			
		D8C1	D8C2	D8C3	D8C4	D8C1	D8C2	D8C3	D8C4	D8C1	D8C2	D8C3	D8C4	D8C1	D8C2	D8C3	D8C4	D8C1	D8C2	D8C3	D8C4
BAL	DE	1				4				5	1										
	DK	2	1	1		1				2	1										
	EE	3	1	1	1	3				7		1									
	FI	4								4		1									
	LT									1											
	LV									5	1	1									
	PL		1							5											
	SE	5	1			4			3	6	1	1	1								
BLK	RO	1																			
MED	CY					1								3							
	ES			1	1									1	1						
	FR													1							
	HR		1	1		4															
	IT	1	1																		
	SI	1		1																	
NEA	BE	5	1							1											
	DE	3				3												4	3	1 (BON - 002)	

	DK	2	1	1		1												2	2		
	ES			1	1													4	4		
	FR																	2	1		3 (BON-001, BON-002, BON-003)
	IE	2				2												4	5	1 (BON-001)	
	NL					1												2	1	1 (BON-001)	
	SE	5	1		1	4			3									2	2	3 (BON-001, BON-002, BON-003)	

Figure 86 shows the monitoring types indicated by MS for D8 criteria. In-situ sampling coastal and offshore are the most common monitoring types for D8C1 and in-situ sampling coastal also for D8C2. For D8C3, visual observation is indicated by 6 MS and remote satellite imagery by 5 MS (all from the Baltic region).

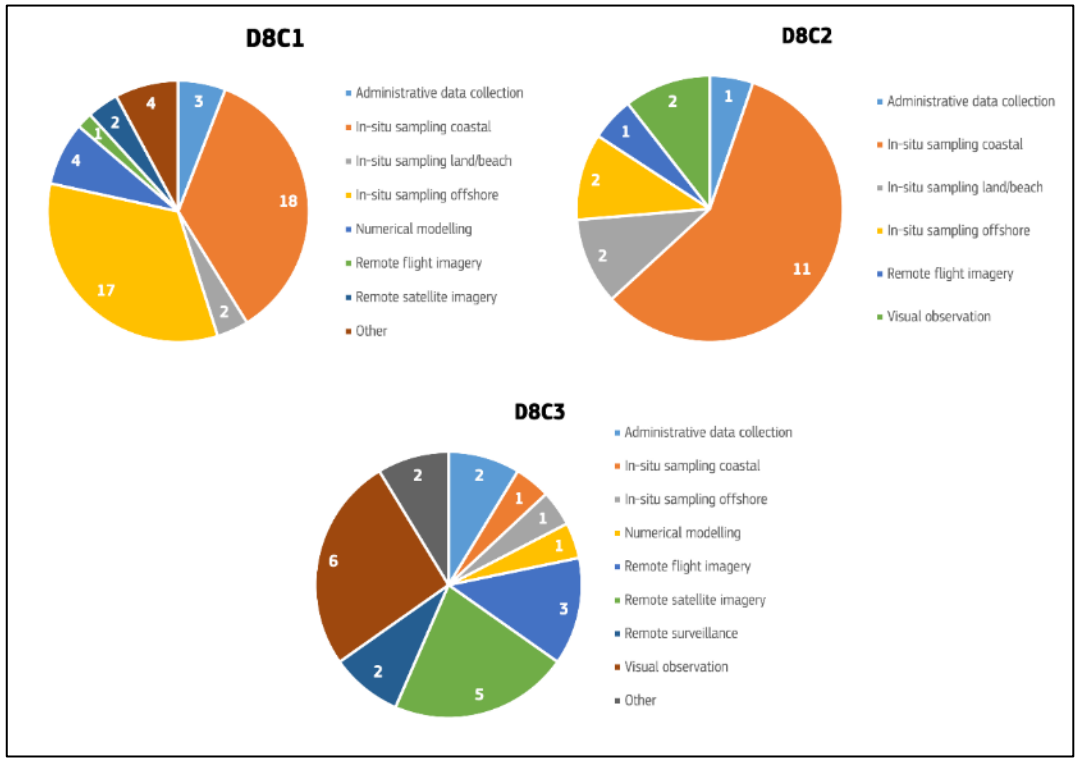


Figure 86. Number of MS using the different monitoring types for D8 criteria.

D9

Many MS have indicated the use of sampling and analysis methods set under EU Food Safety Regulation that are directly applicable to the countries (EE, ES, FR, IE, LT, LV, NL, SI). Some methods agreed within the WFD are also indicated, namely WFD-025 (DK, SE) and WFD-032 and WFD-033 (CY, SE). Regional methods are reported by few MS, namely HEL-001 (FI), HEL-028 (SE), HEL-032 (PL, SE), OSP-28 (DK, FR), and BC-001 (CY, FR). Interestingly, FR also indicates the OSPAR method OSP-028 for the Western Mediterranean subregion (method codes from list 'MonitoringMethod_Enum' in the MSFD Guidance Document 17).

Sometimes, MS (BE, DK, HR, IT, SE) provide under the 'MonitoringMethod' reporting field, references or links to data sheets or reports, which describe the different monitoring methods and/or analysis procedures, but that do not allow the understanding of whether the methods used are those agreed at EU or regional level.

The majority of MS have indicated in-situ sampling coastal and/or in-situ sampling offshore as monitoring types (Figure 87). However, ES has only indicated administrative data collection. 3 MS (BE, CY, LV) have reported 'other' as monitoring type.

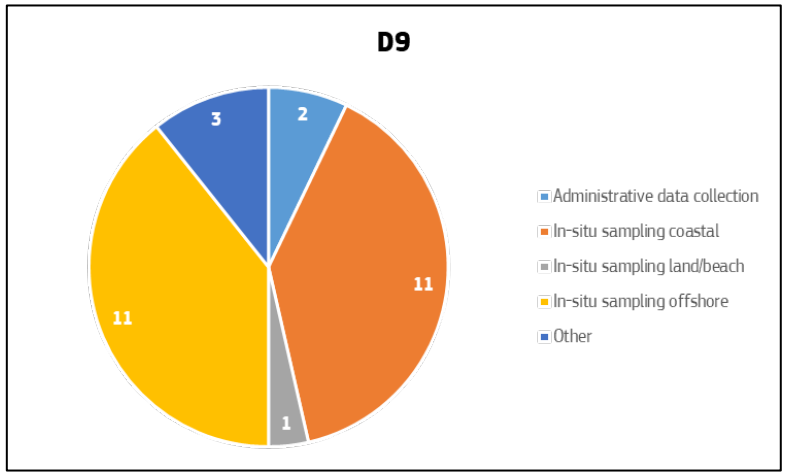


Figure 87. Number of MS using the different monitoring types for D9.

D10

The monitoring methods reported by MS refer to methods agreed at EU level, regional level and other methods, which mainly concern to national monitoring programmes and research programmes (Table 69). 13 MS (BE, DE, DK, EE, ES, FI, HR, IT, NL, PL, RO, SE, SI) have indicated 'other' methods in addition to those regionally agreed at EU or regional level. In relation to D10C1, many MS referred to the agreed methods at their respective marine regions (e.g., DK and SE reported HELCOM methods in BAL region

and OSPAR methods in NEA region), but also to the methods agreed in the MSFD TG Litter[14] through the 'Monitoring Guidance for Marine Litter in the European Seas'[15]. However, CY and LT also indicated the use of methods other than those agreed in their marine regions (e.g., CY indicated Barcelona Convention but also OSPAR methods, and LT reported OSPAR methods). RO only reported 'other' methods on D10C1.

In relation to D10C2 and D10C3, MS mainly referred to the methods agreed in the MSFD TG Litter for all marine regions, particularly in the MED region. For D10C4, MSFD TG Litter and 'other' methods were indicated by only 3 MS (EE, FR, SI and DE, EE, SI, respectively).

Overall, these findings suggest that there is still need for harmonisation across MS at regional or EU level, particularly for D10C2, D10C3 and D10C4, to improve the consistency in the use of monitoring methods.

The diverse types of monitoring reported for the different D10 criteria are shown in Figure 88. MS mostly reported the different types of in-situ monitoring for each criterion. The criteria with the highest variability of reported monitoring types are D10C4 and especially D10C1, with 10 reported categories.

Table 69. Number of monitoring methods reported by MS for D10 per criteria and marine region (Common Fisheries Policy (CFP); HELCOM (HEL); Barcelona Convention (BC); TG ML guidance on monitoring litter (EC); OSPAR (OSP); North-East Atlantic Fisheries Commission (NFC)). *MS that have reported on combined regions (BAL/NEA or NEA/MED).

	MS	Other				CFP				HEL				BC				OSP				EC				NFC			
		C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4
BAL	DE	4	1	1		1																							
	DK*		1			2				1												1	1						
	EE	2	1		1					2													1		1				
	FI	1	1							1																			
	LT																	1	1										
	LV									1												1	1						
	PL		1							1																			
	SE*	1	1			1				1																			
BLK	RO	1																											
MED	CY													1		1		2				1		1					
	ES*	2	2	1		2																1	1	1					
	FR																					1	1	1	1				
	HR		1																			1	1	1					
	IT	2	1	1																									
	SI	1	1	1	1																	1	1	1	1				
NEA	BE	1		1														1											
	DE	2	1	1	1	1												1		1									
	DK*		3															2	1			1	1						

(14) Technical Expert Group on marine litter under the MSFD Common implementation strategy – see Implementation of EU Coastal and Marine Policy - European Commission (europa.eu)

(15) MSFD Technical Subgroup on Marine Litter. 2013. Monitoring Guidance for Marine Litter in the European Seas. A guidance document within the Common Implementation Strategy for the Marine Strategy Framework Directive. ISSN 1831-9424, doi:10.2788/99475

	MS	Other				CFP				HEL				BC				OSP				EC				NFC			
		C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4
	ES*	2	2	1		2												2				1	1	1					
	FR																	2		1		1	1	1	1				
	IE					5												2								2			
	NL		1															3		1									
	SE*	1	1			1												2											

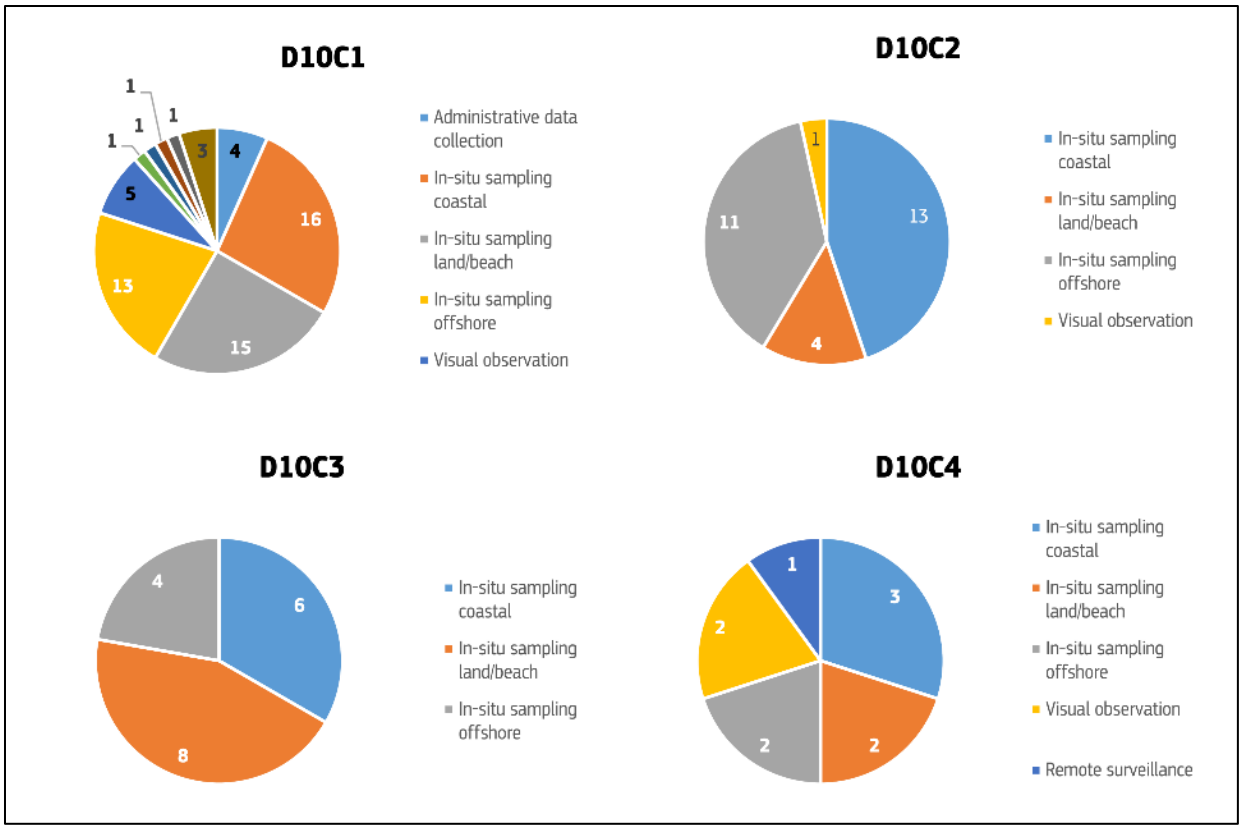


Figure 88. Number of MS using the different monitoring types for D10 criteria.

D11

Some methods agreed at EU level are available and used for monitoring (EC-002, EC-003), as well as methods agreed under OSPAR (OSP-16, for impulsive sound monitoring) and HELCOM (HEL-001 and HEL-036, respectively for impulsive and continuous sound monitoring). Within the BAL, NEA and BLK regions, most MS indicated the use of these methods, and a smaller proportion indicated the use of 'other', not commonly agreed methods. On the contrary, most MS in the MED indicated the use of other methods for monitoring (Table 70).

In addition to what is reported under the field 'Monitoring method', several MS made reference in the description of their monitoring programmes to the TG Noise monitoring guidance for underwater noise in European seas'[16], which serves as a basis for guiding the implementation of monitoring this descriptor across MS.

Table 70. Number of monitoring methods reported by MS for D11 per criteria and marine region (TG Noise Monitoring guidance (EC); HELCOM (HEL); OSPAR (OSP)).

	MS	Other		EC		HEL		OSP	
		D11C1	D11C2	D11C1	D11C2	D11C1	D11C2	D11C1	D11C2
BAL	DE	2	2						
	DK	1	1	1	1		1	1	
	EE	1					1	1	
	FI			1	1				
	LT			1	1				
	LV			1	1				
	PL					1	1		
	SE		2	1	1		1	1	
BLK	RO			1	1				
	CY	1	1						
	ES	1	1	1	1				
	HR								

(16) TG NOISE. 2014. Monitoring Guidance for Underwater Noise in European Seas. A guidance document within the Common Implementation Strategy for the Marine Strategy Framework Directive. ISBN 978-92-79-36341-2, doi: 10.2788/29293

	MS	Other		EC		HEL		OSP	
		D11C1	D11C2	D11C1	D11C2	D11C1	D11C2	D11C1	D11C2
MED	FR	1	1	1	1				
	IT	1	1						
	SI	1	1						
NEA	BE	1	1						
	DE	2	2						
	DK	1	1	1	1		1	1	
	ES	1	1	1	1				
	FR	1	1	1	1				
	IE			1					
	NL		1					1	
	SE		2	1	1		1	1	

The types of monitoring applied for features, elements and/or parameters under D11C1 and D11C2 are shown in Figure 89, and are highly variable across regions. However, the majority of MS indicated that the most applied type of monitoring is administrative data collection, while numerical modelling, in-situ sampling and remote surveillance are the most applied types of monitoring for D11C2.

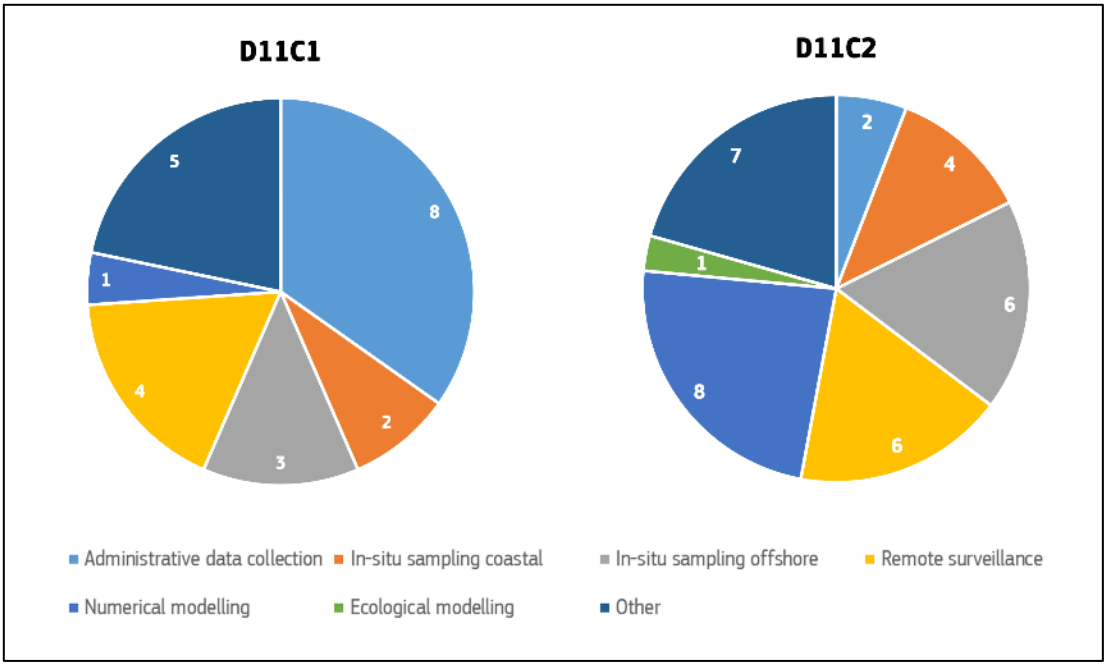


Figure 89. Number of MS using the different monitoring types for D11 criteria.

D1-Marine Mammals

Most MS indicated monitoring methods which are not agreed at EU or regional level. HELCOM and OSPAR are the two main sources of agreed methods which is verified by the established indicators included in their Quality Status Reports.

For D1C1, five different methods were reported for all species and regions. Although they cover all possible monitoring methods, it seems that the MS do not consistently used the predefined categories and assigned different categories to the same method. Given the short number of marine mammals that have established programmes for bycatch and the few established monitoring programmes, the five reported categories seem to be overused (Table 71).

For the other criteria, MS reported a plethora of methods, which could be explained by the combination of different techniques to monitor mammals and by the different techniques by species group. Despite the commonalities, Figure 90 shows the gaps in harmonisation and in data across the MS and criteria (especially for D1C1 and D1C5). More work is required at technical level (i.e., at the MSFD Biodiversity Expert Network) to harmonise monitoring methods for each criterion and region, refine the reporting guidance accordingly and promote the joint monitoring programmes for those highly mobile species.

Table 71. Number of monitoring methods reported by MS for D1 - mammals per marine region (Barcelona Convention (BC); Black Sea Commission (BSC); HELCOM (HEL); OSPAR (OSP); Other (OTH); Water Framework Directive (WFD); Common Fisheries Policy (CFP); Common Wadden Sea (CWS)).

	MS	Other	WFD	HEL	BC	BSC	OSP	CFP	CWS
BAL	DE	1		1			1		1
	EE	1		1					
	DK	1		2			1		
	FI	1		2					
	LT	1							
	LV	1		1					
	PL	1		2					
	SE	1		3			2		
BLK	RO	1							
MED	CY	1	5						
	ES	1							
	HR	1							
	FR	1			1		3		
	IT	1							
NEA	SI	1							
	BE	1							
	DE	1		1			1		1
	ES	1							
	FR	1			1		3		
	NL	1					3		
	DK	1		2			1		
	IE	1					6		
	SE	1		3			2		

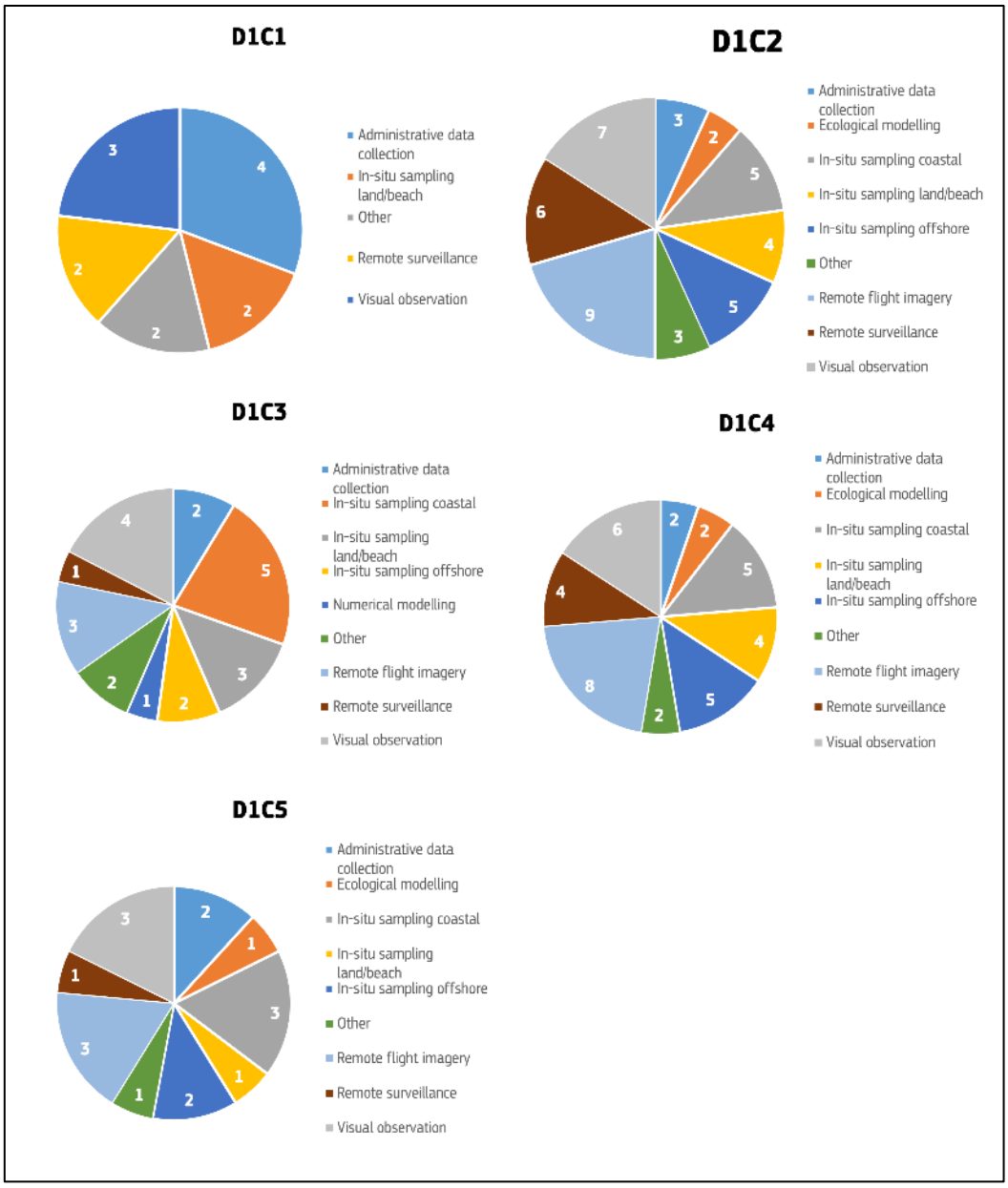


Figure 90. Number of MS using the different monitoring types for D1 criteria - Marine mammals.

D1-Marine Reptiles

The reporting of the methods for monitoring each parameter and criterion is crucial, because it provides an overview of the level of harmonisation and provides potential good practices, which can be the basis for coordinated and joint monitoring programmes. For D1C1, three different methods were reported, which refer to different species and regions, so no conclusion can be made (D1C1 reported by 1 MS in NEA and one in MED for two species). For D1C2, 5 MS (CY, ES, HR, IE, IT) reported eight methods for six different species. It is obvious that more than one method was reported for the same species. This lack of consistency can, however, be caused by the different allocation of the monitoring methods to the predefined categories (Table 72).

D1C3 has also eight different categories of methods reported, but given the increased number of reported parameters for this criterion it seems logical. D1C4, in turn, has also eight methods reported very similar to D1C2, so we assume that the MS reported the same category for each species for both D1C2 and D1C4 since the information for these criteria comes from the same source (HD). Finally, D1C5 has seven methods reported, which seems too excessive taking into account that only 3 MS (HR, IE, IT) reported on this criterion and for only two species (Figure 91). More work to harmonise both the reporting, through a clarified version of the guidance, and the monitoring, through regional collaboration and work in the expert groups, is needed to harmonise the monitoring for sea turtles in the EU waters.

Table 72. Number of monitoring methods reported by MS for D1 - reptiles per marine region (Barcelona Convention (BC); Black Sea Commission (BSC); HELCOM (HEL); OSPAR (OSP); Other (OTH); Water Framework Directive (WFD); Common Fisheries Policy (CFP)).

	MS	Other	WFD	HEL	BC	BSC	OSP	CFP
NEA	IE	1					6	
NEA/MED	ES	1						
MED	CY		5		1			1
	HR	1						
	IT	1						
	FR	1						

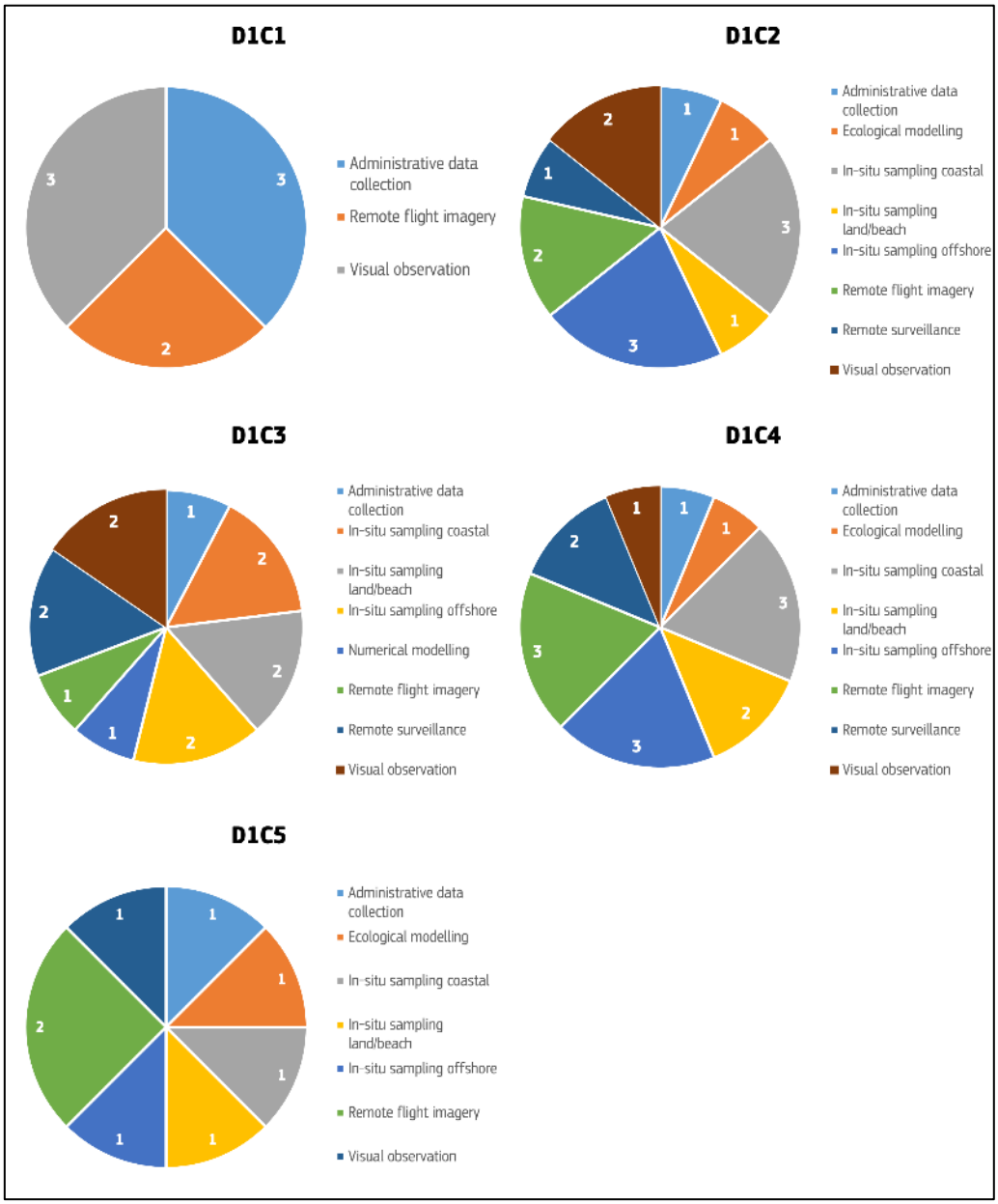


Figure 91. Number of MS using the different monitoring types for D1 criteria - Marine reptiles.

D1-Fish and Cephalopods

The main methods that the MS reported for fish and cephalopods are coming from the established monitoring programmes from the CFP, and, in some cases, from some dedicated monitoring programmes from the RSC or

HD (Table 73). There are two striking outcomes, which should be explained considering that depending on the species group, different methods are applied for the coastal, demersal, pelagic and deep-fish species. The first one is the very few methods reported by only 6 MS (BE, DK, DE, EE, RO, SI) for D1C1 and another 6 MS (CY, DE, DK, IE, NL, SI) for D1C5, for all species and species groups. This is in line with the findings above, and more work is needed to develop common agreed methods for those criteria at regional level. Second, the MS do not consistently assign methods to the default options (Figure 92). For instance, for D1C2, it is obvious that raw data derived from the CFP could be assigned to in-situ sampling, while the same information could also be assigned to administrative data collection, when it is retrieved by the ministry or organization responsible for the CFP. Moreover, the in-situ coastal, offshore and land/beach refer in some cases to the same monitoring method. As such, only with the information reported in the 'Monitoring type' field, a meaningful analysis cannot be conducted.

Table 73. Number of monitoring methods reported by MS for D1 – Fish and cephalopods per marine region (Barcelona Convention (BC); Black Sea Commission (BSC); HELCOM (HEL); OSPAR (OSP); Water Framework Directive (WFD); Common Fisheries Policy (CFP); Common Wadden Sea (CWS); International Commission for the Conservation of Atlantic Tunas (ICCAT)).

	MS	Other	WFD	HEL	BC	BSC	OSP	CFP	CWS	ICCT
BAL	DE	5	6					8		
	DK	5		3						
	EE	3		3						
	FI	3		1						
	LT			3						
	LV			2						
	PL	2		2				1		
	SE	3		3			1	6		
MED	CY	4	20		4			4		
	ES	3					3	9		3
	HR	3								
	FR	2						8		2
	IT	2								
	SI	4								
NEA	BE	3								
	DE	5	6					8		
	DK	5		3						
	ES	3					3	9		
	FR	2						8		2
	NL	4					1	8		
	SE	3		3			1			
	IE	5					15	8		3

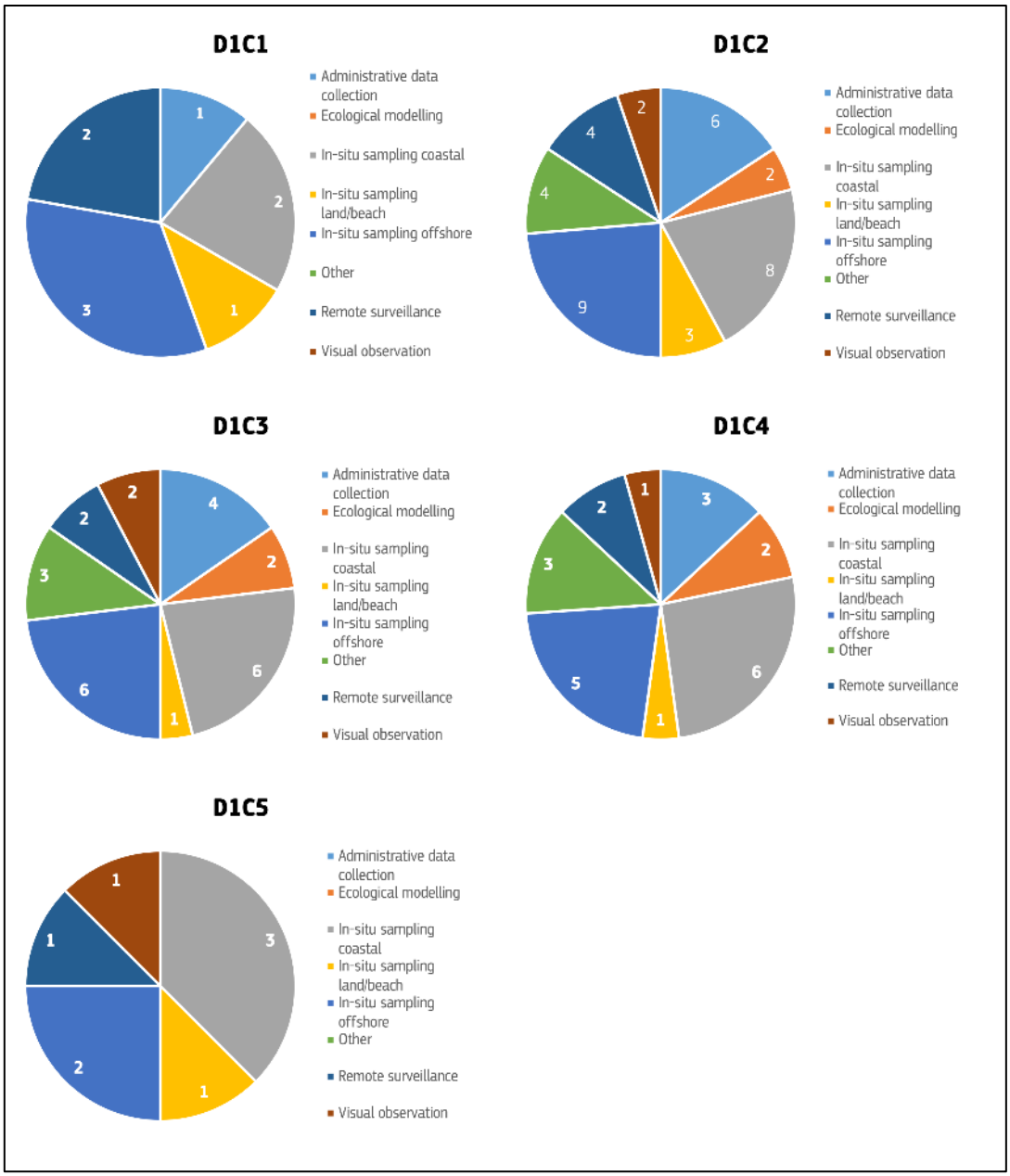


Figure 92. Number of MS using the different monitoring types for D1 criteria – Fish and cephalopods.

D1-Seabirds

Most MS indicated monitoring methods which are agreed at EU or regional level. In the BAL, NEA and MED regions and sub regions, all MS reported the use of the listed methods, and only one MS (DE) reported the use of 'other' methods (Table 74). The majority of MS indicated visual observation, in-situ sampling coastal, and in-situ sampling land beach for monitoring features/elements/parameters listed under D1 criteria Figure 93).

For D1C1, seven different methods were reported for all species and regions. Although they cover all possible monitoring methods, some of them are not suitable to generate bycatch data (remote flight imagery and visual data), questioning the selections from the available list. A more specific selection of methods, tailor-made for each criterion, and clarification in the reporting guidance would improve the reporting of methods. This should be supported by the access to data (as analysed in section 4.2.5).

For D1C2, 9 MS reported 'in-situ sampling coastal', which is the most common method. 'Visual observation' is the most common method for D1C3 and 'in-situ sampling coastal' for D1C4. Three different methods are common (reported by 3 MS) for D1C5. Despite these commonalities, Figure 93 shows gaps in harmonisation and in data across the MS and criteria, which are more evident for D1C1 and D1C5. More work is required at

technical level (i.e., at the MSFD Biodiversity Expert Network) to harmonise monitoring methods for each criterion and region and refine the reporting guidance accordingly.

Table 74. Number of monitoring methods reported by MS for D1 – Seabirds per marine region (Barcelona Convention (BC); Black Sea Commission (BSC); HELCOM (HEL); OSPAR (OSP); Water Framework Directive (WFD); Common Fisheries Policy (CFP); Common Wadden Sea (CWS)).

	MS	Other	WFD	HEL	BC	BSC	OSP	CFP	CWS
BAL	DE	6		8			10		18
	EE	3		3					
	FI	7		2					
	LT			1					
	LV			1					
	PL	3		1					
	SE	8		6			8		
MED	CY	2	10		2			2	
	ES	8							
	HR	5							
	FR	11		1			10		
	IT	3							
NEA	SI	5							
	BE	2							
	DE	6		8			10		18
	ES	8							
	FR	11		1			10		
	NL						2		
	SE	8		6			8		

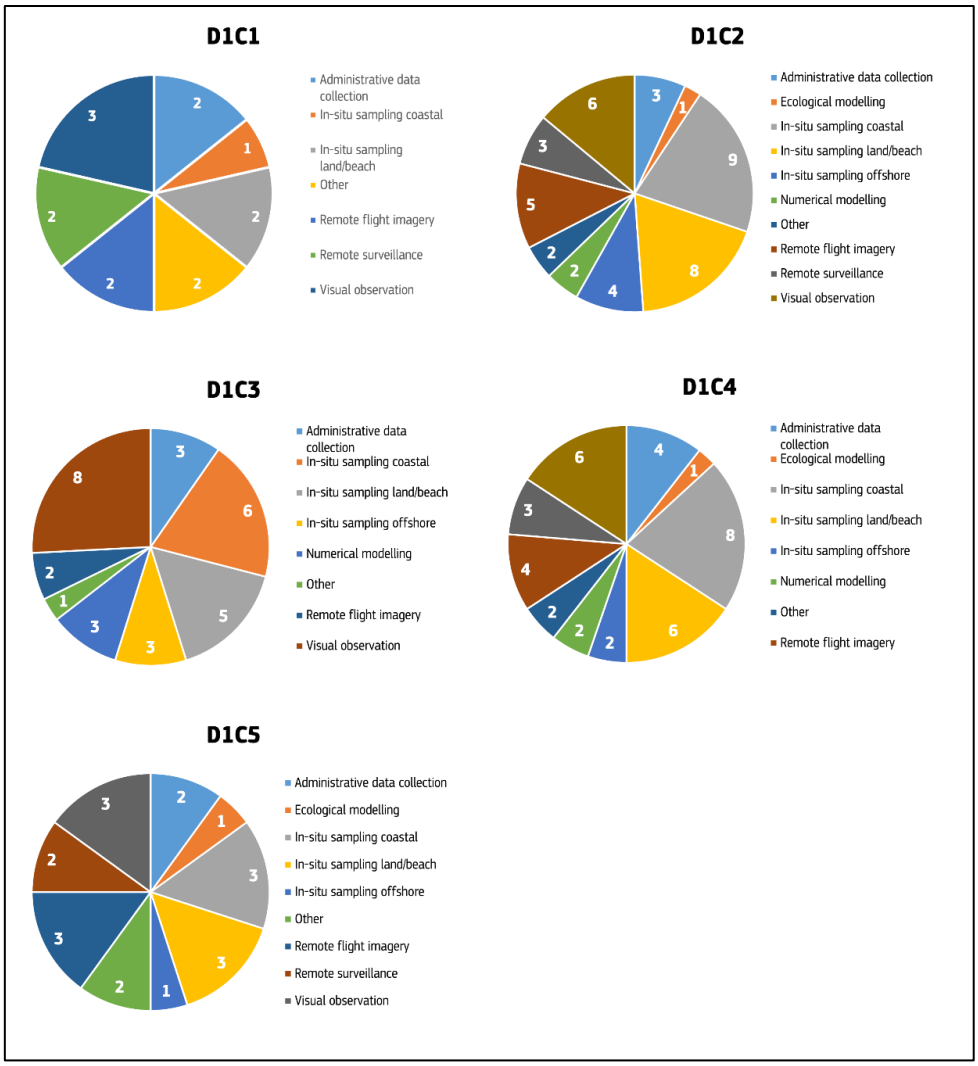


Figure 93. Number of MS using the different monitoring types for D1 criteria – Seabirds.

D1-Pelagic Habitats

Fifteen MS reported for monitoring methods under D1C6. The number of methods differed across marine region (Table 75). Methods falling within the 'Other' category were reported by BE, EE, ES, FR, HR, IT, RO, SE, and SI.

Table 75. Number of monitoring methods for D1C6 per marine region (Barcelona Convention (BC); Black Sea Commission (BSC); HELCOM (HEL); OSPAR (OSP); Water Framework Directive (WFD); Other (OTH)).

	MS	BC	BSC	HEL	OSP	OTH	WFD
BAL	EE			2		1	
	LT			1			
	LV			1			
	FI			3			
	PL			4			
	DE			4		1	
	SE			11		7	
BLK	RO		2			1	
MED	FR	1				2	2
	HR					1	
	IT					1	
	SI					1	
	ES					1	
NEA	FR				5	2	
	NL				1		
	BE					1	
	DE					1	
	ES					1	
	SE				5	7	

D4

Sixteen MS reported for the D4 criteria and provided information on the applied monitoring methods (Table 76). The agreed methods mostly used are those agreed under RSC: 16 methods under OSPAR, 9 methods under HELCOM and 1 method agreed under the Barcelona Convention in the Mediterranean Sea. The North East Atlantic Fisheries Commission (NFC) provided 2 agreed methods used by 1 MS (IE), whereas the MEDIAS provided with 9 methods used by 10 MS (3 MS in BAL, 3 MS in MED, 4 MS in NEA). FR is the only MS reporting for WFD agreed methods for D4 criteria

Table 76 Number of monitoring methods reported by MS for D4 per marine region (Barcelona Convention (BC); Black Sea Commission (BSC); HELCOM (HEL); OSPAR (OSP); Water Framework Directive (WFD); Common Fisheries Policy (CFP); North East Atlantic Fisheries Commission (NFC); International Commission for the Conservation of Atlantic Tunas (ICCAT)).

	MS	OTH	WFD	HEL	OSP	BC	ICCAT	CFP	NFC
BAL	EE	4		3	2				
	FI	4		8					
	IE	2						5	2
	LT			3					
	LV			2					
	PL	3		9				1	
	SE	9		9	7			2	
MED	CY		1					1	
	ES	5		2	7	3	2	9	
	HR	1							
	IT	1							
	FR	7	2	1	11	2	1	6	
	SI	1							
NEA	BE	1							
	DK	1							
	ES	5		2	7	3	2	9	
	FR	7	2	1	11	2	1	6	
	NL	1			1			2	
	SE	9		9	7			2	

D6

Eighteen MS reported for D6 criteria and provided information on the applied monitoring methods (Table 77). The number of reported agreed methods at HELCOM level were 18, and eight methods at OSPAR level. One method was reported by DE under the agreed methods proposed by the CWS and two WFD agreed methods were also reported by CY, DE, FR, HR, IE, and NL. RO reported for the agreed method HEL-32 for performing monitoring in the COMBINE Programme under HELCOM. Methods falling within the 'Other' category were reported by BE, DE, DK, EE, ES, FI, HR, IE, IT, NL, RO, SE, and SI.

Table 77. Number of monitoring methods reported by MS for D4 per marine region (Barcelona Convention (BC); Black Sea Commission (BSC); HELCOM (HEL); OSPAR (OSP); Water Framework Directive (WFD); Common Fisheries Policy (CFP); North East Atlantic Fisheries Commission (NFC)).

	MS	BC	BSC	CFP	HEL	NFC	OSP	OTH	WFD
BAL	DE				8		6	9	
	DK							5	
	EE				6		2	9	1
	FI				2			6	
	LT				3				
	LV						2	3	
	SE					2		4	
	PL		2					3	
BLK	RO				5		3	6	
MED	CY	3		3				3	15
	SI							2	
	FR						2	3	
	HR							3	
	IT				1			4	
	ES	12		6		3	42	17	11
NEA	BE							4	
	IE			5		2	4	3	
	DE				8		6	9	
	DK							5	
	ES	12		6		3	42	17	11
	SE					2		4	
	NL				1	2		2	

4.3.1 Regional coordination

According to the monitoring reporting guidance, MS should report on the degree of cooperation among countries within the same (sub)region by selecting a category of the level of implementation:

- Agreed data collection methods
- Common monitoring strategy (spatial and temporal design of programme)
- Coordinated data collection (delivered separately by each country)
- Joint data collection (multinational delivery using same platform and/or algorithms)

D2

There are not common monitoring strategies across marine regions despite there are agreed data collection methods among BAL, MED and NEA. The criterion D2C3 is underrepresented.

Table 78. Number of MS reporting for the regional cooperation implementation for D2 criteria.

	Not reported				Agreed data collection methods				Common monitoring strategy				Coordinated data collection			
	BAL	BLK	MED	NEA	BAL	BLK	MED	NEA	BAL	BLK	MED	NEA	BAL	BLK	MED	NEA
D2C1	2		3	3	2			2	2	1		1	2		1	1
D2C2	2		4	2	2			1	1	1			4		1	2
D2C3	1		1							1			1			

D3

All but 4 MS (HR, IT, LT, SI) reported some form of regional cooperation under 'RegionalCooperation_implementation'. The most common forms of regional cooperation reported were 'Agreed data collection methods' and 'Coordinated data collection' (Table 79). Regional cooperation was reported more frequently by MS in BAL and NEA than in MED. However, only 5 MS of these MS (BE, DE, DK, PL, SE) also reported the countries involved under 'RegionalCooperation_countries', while the other 9 MS (CY, EE, ES, FI, FR, IE, NL, LV, RO) did not. 3 MS (DK, EE, FR) reported more than one type of regional cooperation, with DK reporting all four types (Table 79). For D3, the available types of regional cooperation are not particularly informative.

Table 79. Level of implementation of D3 monitoring programmes and coordination among countries within the same region.

	Agreed data collection methods			Common monitoring strategy				Coordinated data collection		Joint data collection		
	BAL	MED	NEA	BAL	NEA	BLK	MED	BAL	NEA	BAL	MED	NEA
D3C1	EE, FI, DK*	FR, ES*	BE, FR, IE, DK*, ES*	DK*	DK*	RO	CY	DE, EE, LV, PL, DK	DE, DK*	DK*, SE*	FR	FR, NL, DK*, SE*
D3C2	EE, FI, DK*		BE, IE, DK*, ES*	DK*	DK*	RO	CY	DE, EE, PL, DK*, SE*	BE, DE, DK*, SE*	DK*, SE*	FR	FR, NL, DK*, SE*
D3C3	EE, FI, DK*		BE, DK*	DK*	DK*	RO	CY	DE, EE, PL, DK*, SE*	BE, DE, DK*, SE*	DK*, SE*		DK*, SE*

*For those MS that have reported mixed subregions (DK, SE - BAL/NEA; ES – MED/NEA) the types of regional cooperation have been indicated for each of their subregions.

D5

Table 80. Number of MS reporting for the regional cooperation implementation for D5 criteria.

	Agreed data collection methods				Common monitoring strategy				Coordinated data collection				Joint data collection			
	BAL	BLK	MED	NEA	BAL	BLK	MED	NEA	BAL	BLK	MED	NEA	BAL	BLK	MED	NEA
D5C1	1		1	4	1	1	1		6		2	5				
D5C2			1	3		1	1	4			1	3			1	1
D5C3						1			5		1	3				
D5C4	1		1		1	1			1		1	2				
D5C5	1		1	3	1	1	1		3		2	4				
D5C6	1		1	3	1	1			1							

D5C7	1		1	3	2				1							
D5C8				1	1				2			1				

D7

Regional coordination is implemented at different levels across marine regions, with only 6 MS out of the 18 reporting at this stage indicating that either joint or coordinated data collection is taking place, and 6 MS that either agreed data collection methods or a common monitoring strategy are used (Table 81). The levels of coordination are variable within each region, with all the levels of implementation reported by at least 1 MS in the BAL region, where only 4 MS (DK, EE, PL, SE) indicated HELCOM as the coordinating body, and most MS indicate other/null values as coordinating body. In the NEA region, 3 MS indicated a coordinated/joint data collection, and 3 MS indicated the use of agreed data collection methods. In this region, 6 MS (DK, ES, FR, IE, NL, SE) indicated OSPAR as the coordinating body. Within the MED region, the only regional coordination indicated is coordinated data collection, reported by 3 MS, which also indicated the BARCON as the coordinating body. Finally, 1 MS in the BLK region indicated BSC as the coordinating body and the use of a common monitoring strategy.

Table 81. Level of implementation of D7 monitoring programmes and coordination among countries within the same region.

	Agreed data collection methods				**Common monitoring strategy**				**Coordinated data collection**				**Joint data collection**			
	BAL	**BLK**	**MED**	**NEA**	**BAL**	**BLK**	**MED**	**NEA**	**BAL**	**BLK**	**MED**	**NEA**	**BAL**	**BLK**	**MED**	**NEA**
D7C1	DK			DK, IE, NL					SE		CY, ES, FR	ES, FR, SE	LV, SE			SE
D7C2	DK			DK, NL	LV	RO			EE, SE		ES, FR	ES, FR				

D8

Regional coordination is seen basically in the Atlantic and Baltic regions and for the criteria D8C1 and D8C3, where most MS have reported a coordinated data collection (Table 82). For D8C2, a coordinated data collection is also frequently reported by MS in the OSPAR area. Coordination seems to be less effective in the Mediterranean, where a number of MS (HR, IT, SI) have not indicated anything under the 'Regional cooperation_implementation' reporting field. The level of regional coordination has not been reported either by LT or by some MS for some of the monitoring programmes (BE for WFD substances in coastal waters, DE for many contaminants in the Atlantic region, SE for one D8C1 element (*Escherichia coli*) and national parameters for D8C2, and EE for the assessment of oil pollution on seabirds (D8C4)).

Table 82. Level of implementation of D8 monitoring programmes and coordination among countries within the same region.

	Agreed data collection methods				**Common monitoring strategy**				**Coordinated data collection**				**Joint data collection**			
	BAL	**BLK**	**MED**	**NEA**	**BAL**	**BLK**	**MED**	**NEA**	**BAL**	**BLK**	**MED**	**NEA**	**BAL**	**BLK**	**MED**	**NEA**
D8C1	DE, DK, PL			DE, DK, IE	FI	RO	CY, ES	ES, IE	DE, EE, FI, LV, SE		ES	BE, DE, ES, IE, NL, SE	DE, DK, FI		FR	BE, DE, DK, FR
D8C2	DE, DK, PL			DE, DK	LV		ES	BE, ES	EE, NL		ES	ES, IE, NL, SE				DE, FR
D8C3	DK			BE, DK					EE, FI, LV, SE		ES	ES, IE, NL, SE				
D8C4								FR			ES	ES, SE				

For those MS that have reported mixed subregions (DK, SE - BAL/NEA; ES – MED/NEA), the types of regional cooperation have been indicated for each of their subregions.

D9

As said above, most D9 data come from national monitoring programmes conducted under Foodstuffs Regulation. Coordinated data collection is indicated by 4 MS in the Atlantic, although to our understanding, the assessment of contaminants in fish and seafood for human consumption is not specifically addressed under OSPAR.

Many MS (EE, FI, HR, IT, LT SI) have not indicated anything under the 'Regional cooperation_implementation' reporting field. Likewise, no coordination level is indicated by FR for toxins and microbiological contamination and by SE for the assessment of dioxins and PCBs complementary to food control.

Table 83. Level of implementation of D9 monitoring programmes and coordination among countries within the same region.

	Agreed data collection methods				Common monitoring strategy				Coordinated data collection				Joint data collection			
	BAL	BLK	MED	NEA	BAL	BLK	MED	NEA	BAL	BLK	MED	NEA	BAL	BLK	MED	NEA
D9C1	DK, PL		ES	DK, ES, NL	LV	RO	CY		SE		FR	BE, FR, IE, SE				

For those MS that have reported mixed subregions (DK, SE - BAL/NEA; ES – MED/NEA), the types of regional cooperation have been indicated for each of their subregions.

D10

Regional coordination is implemented at four diverse levels in those 12 MS (BE, DE, DK, ES, FI, FR, IE, IT, LV, NL, RO, SE) that indicated the regional or coordinated cooperation (Table 84). Coordination was variable in each region, although the most frequently levels of implementation reported were 'Common monitoring strategy' and 'Coordinated data collection', particularly for MED/NEA and BAL/MED/NEA regions, respectively. 7 MS (CY, HR, IT, LT, LV, PL, SI) did not reported some form of regional cooperation, although IT indicated BARCON as coordination body. Moreover, only BE reported the countries involved in some level of coordinated cooperation (BE, DE, DK, FR, NL, PL, SE, UK).

MS involved in regional or coordinated cooperation should be reported and more harmonisation on the regional coordination are needed to improve the comparability in monitoring and reporting.

Table 84. Level of implementation of D10 monitoring programmes and coordination among MS within the same region.

	Agreed data collection methods				Common monitoring strategy				Coordinated data collection				Joint data collection			
	BAL	BLK	MED	NEA	BAL	BLK	MED	NEA	BAL	BLK	MED	NEA	BAL	BLK	MED	NEA
D10C1	DK*		ES*	DK*, ES*, IE	DE*,DK*, FI, LV, SE*	RO	FR	DK*, FR, SE*	DE, SE*		ES*	BE, DE, ES*, NL, SE*	DK*			DK*
D10C2	DK*, FI, LV			DK*, NL			ES*, FR	ES*, FR			ES*	ES*				
D10C3	DK*			DK*			FR	FR	DK*		ES*	BE, DE, DK*, ES*, NL				
D10C4							FR	FR								

*For those MS that have reported mixed subregions (DK, SE - BAL/NEA; ES – MED/NEA) the types of regional cooperation have been indicated for each of their subregions.

D11

Regional coordination is implemented at different levels across marine regions (Table 85). Indeed, within the BAL region, most MS indicated that either coordinated (5 MS: DE, DK, EE, LV, SE) or joint data collection (1 MS: FI) are used. In this region, 6 (DE, DK, EE, FI, LV, SE) out of 8 MS indicated HELCOM as the coordinating body and only DE and FI listed the countries involved (which in case of DE are: DK, EE, FI, LV, SE for D11C1 and DK, EE, FI, LV, PL, SE for D11C2, and in case of FI are DE, DK, EE, LT, LV, PL, SE for both criteria). In the NEA region, most MS indicated a coordinated or joint data collection for D11C1 and D11C2. In this region, all 8 MS indicated OSPAR as the coordinating body and only DE listed the countries involved (namely BE, DK, NL, UK). Finally, within the MED region, only 2 MS (ES and FR) filled the relevant field, indicating that a common monitoring strategy is used for D11C1 monitoring, and either agreed data collection methods or a common monitoring strategy are used for D11C2 monitoring. ES listed BARCON as the coordinating body. No information was reported on regional coordination for the BLK region.

Table 85. Level of implementation of D11 monitoring programmes and coordination among MS within the same region.

	Agreed data collection methods				Common monitoring strategy				Coordinated data collection				Joint data collection			
	BAL	BLK	MED	NEA	BAL	BLK	MED	NEA	BAL	BLK	MED	NEA	BAL	BLK	MED	NEA
D11C1							ES, FR	ES, FR	DE, DK, EE, LV, SE			DE, DK, IE, SE	FI			NL
D11C2			FR	BE, FR			ES	ES	DE, DK, EE, LV, SE			DE, DK, SE	FI			NL

D1-Marine Mammals

The reported information for the regional coordination indicates that the MS considered the established monitoring programmes for the regional indicators, mostly from HELCOM and OSPAR (Table 86). The level of regional coordination is advanced for marine mammals in the BAL and NEA. Recently a joint monitoring programme was established in the MED, although this was not timely delivered for this reporting obligation.

The MSFD Biodiversity Network provides a common communication platform to facilitate knowledge and methods transfer across the regions, by engaging all mammal experts from the MS and the RSCs or other organisations (e.g., ICES, ACCOBAMS, ASCOBANS).

Table 86. Level of implementation of D1- mammals monitoring programmes and coordination among MS within the same region.

	Agreed data collection methods	Common monitoring strategy	Coordinated data collection	Joint data collection
D1C1	DK, FI, FR, LV	RO	DK, LV	BE
D1C2	DK, FI, FR	CY, IE, PL	DE, EE, ES, FI, FR, LV, NL, SE	BE, FR
D1C3	DK, FR	PL	DE, EE, ES, FI, FR, LV, NL, SE	
D1C4	DK, FI, FR	CY, IE, PL	DE, EE, ES, FI, FR, LV, NL, SE	FR
D1C5	DK, NL	IE	DE	

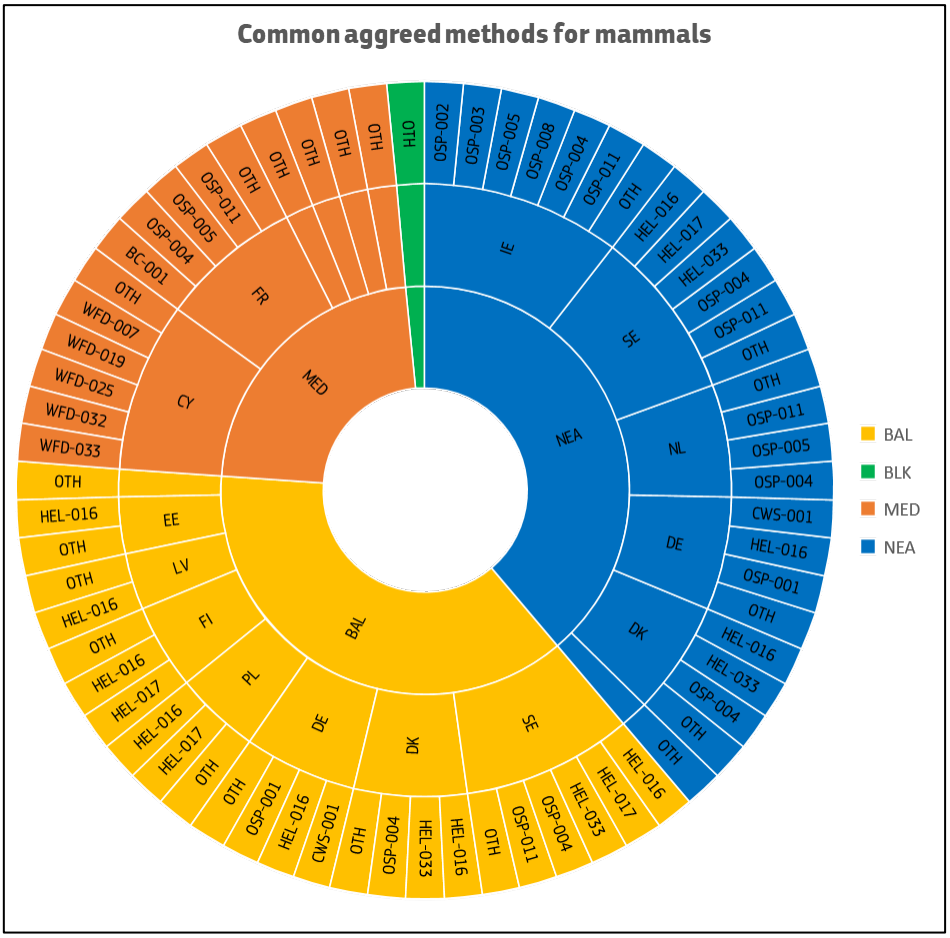


Figure 94. Common agreed methods as reported by MS per region.

D1-Marine Reptiles

Table 87. Level of implementation of D1- reptiles monitoring programmes and coordination among MS within the same region.

	Agreed data collection methods	Common monitoring strategy	Coordinated data collection
D1C1	FR		
D1C2		CY, IE	ES
D1C3		CY	ES

D1C4		CY, IE	ES
D1C5		IE	

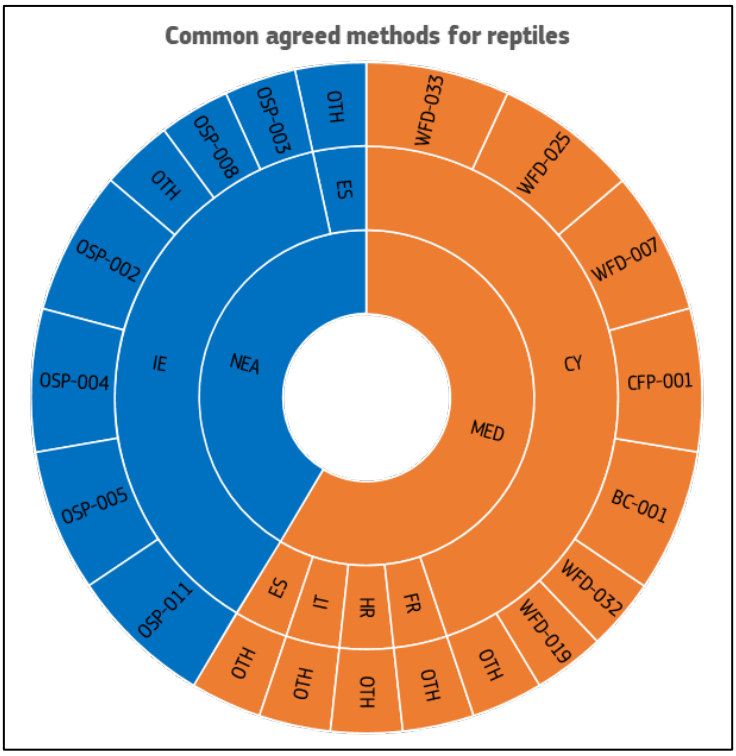


Figure 95. Common agreed methods as reported by MS per region.

D1-Fish and Cephalopods

Table 88. Level of implementation of D1- fish and cephalopods monitoring programmes and coordination among MS within the same region.

	Agreed data collection methods	Common monitoring strategy	Coordinated data collection	Joint data collection
D1C1	BE, DK, EE	DK, RO	DE, DK	
D1C2	BE, DK, EE, ES, FI, IE, PL	CY, DK, FI, IE, RO	BE, DE, DK, EE, ES, LV, SE	DK, FR, NL, SE
D1C3	BE, DK, EE, ES, PL	CY, DK, RO	BE, DE, EE, ES, PL, SE	DK, NL, SE
D1C4	DK,ES,FI, IE	CY, DK, IE	DE, EE, ES, SE	DK, NL, SE
D1C5	IE	CY, DK, IE	DE	NL

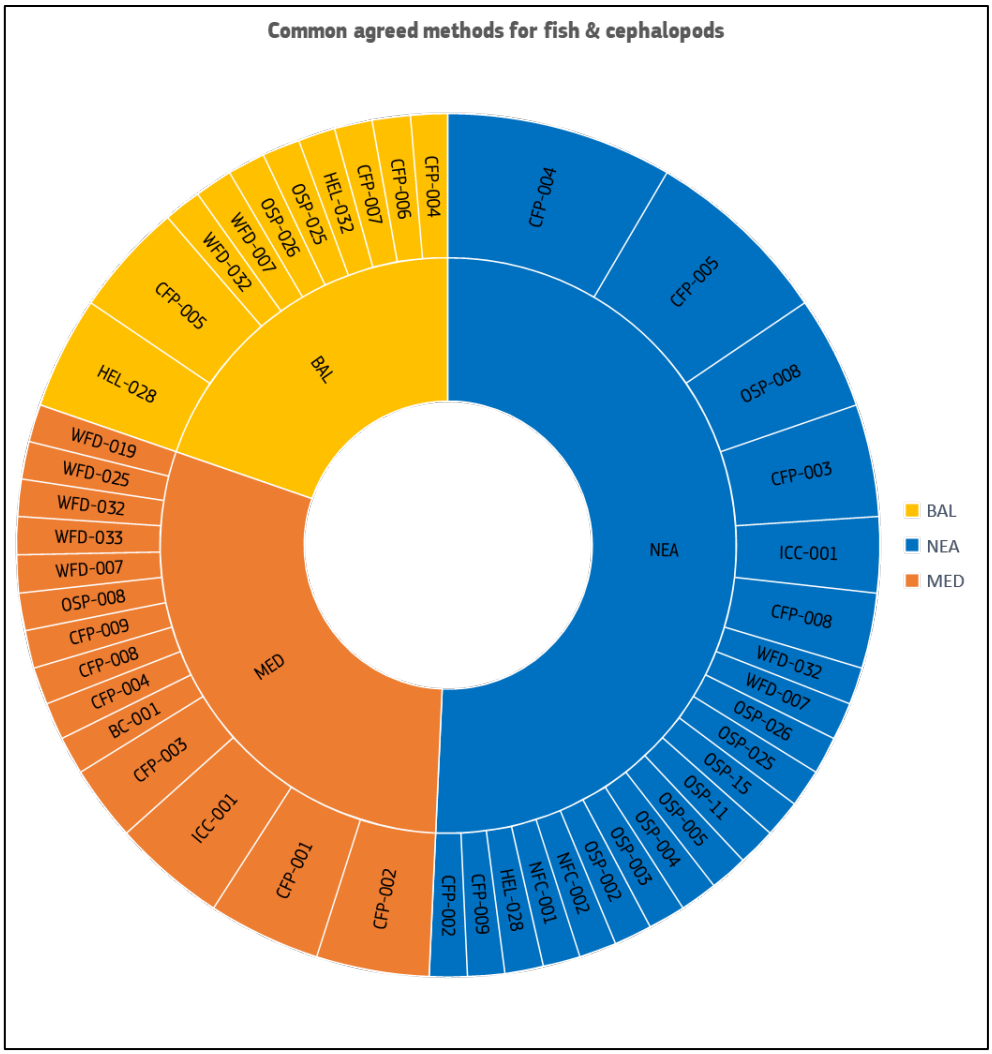


Figure 96. Common agreed methods as were reported by the MS per region.

The reported information for the regional coordination indicates that the MS considered the established monitoring programmes for the regional indicators, mostly from HELCOM (7 MS) and from the CFP (8 MS). Given that all MS have established CFP monitoring programmes for fish and cephalopods, which have harmonised protocols at regional level, it is striking to see than less than half of the MS reported them. Another issue is that common monitoring programmes for regional and EU policies can be inconsistently reported across MS, in one or both categories.

D1-Seabirds

Table 89. Level of implementation of D1- seabirds monitoring programmes and coordination among MS within the same region.

	Agreed data collection methods				**Common monitoring strategy**				**Coordinated data collection**			
	BAL	BLK	MED	NEA	BAL	BLK	MED	NEA	BAL	BLK	MED	NEA
D1C1	DE, FI								DE, FI, LV			DE
D1C2	DE, DK, FI, PL		FR	BE, FR	PL		CY	IE	DE, EE, FI, SE			DE, SE, BE, FR, NL
D1C3	PL			BE, FR	FI				EE, SE			DE, SE, NL
D1C4	DE, DK, FI, PL						CY	IE	DE, EE, FI, SE			DE, SE, FR
D1C5	DE, DK							IE	DE			DE

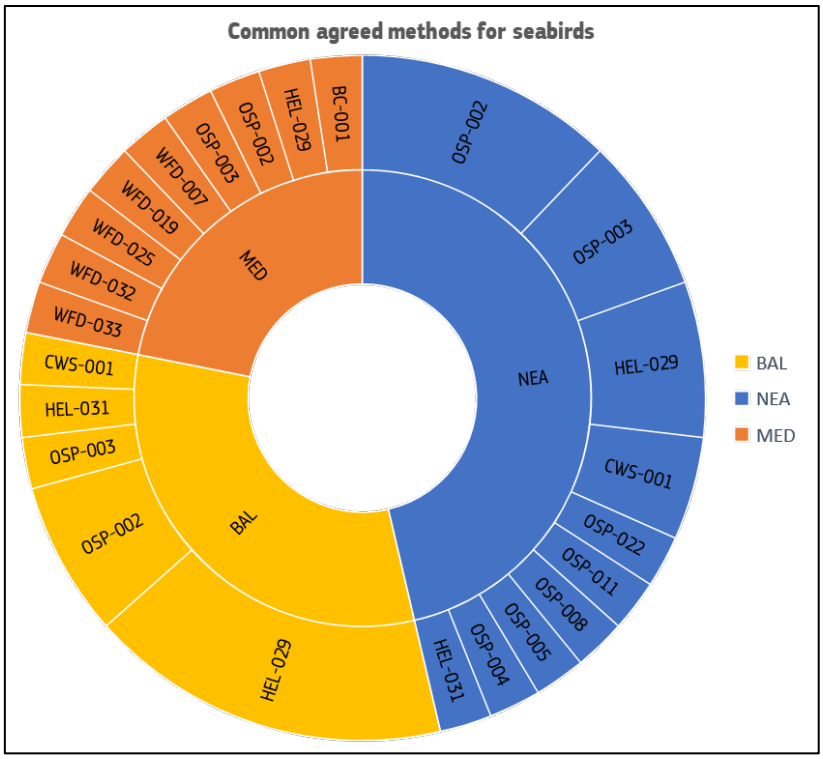


Figure 97. Common agreed methods as reported by the MS per region.

The reported information for the regional coordination indicates that the MS considered the established monitoring programmes for the regional indicators, mostly from HELCOM and OSPAR. The level of regional coordination is much more advanced for seabirds compared to other species groups. The JWG BIRDS ensures the harmonisation of the methods, thresholds and monitoring across all OSPAR and HELCOM contracting parties, and is completely aligned with the MSFD requirements. Moreover, the MSFD Biodiversity Network provides a common communication platform to facilitate knowledge and methods transfer across the regions, by engaging all seabird experts from the MS. As such, the regional cooperation for seabirds is very promising for covering the monitoring and methodological gaps across the EU regions.

D1-Pelagic Habitats

Eleven over 15 MS reported for the field 'RegionalCooperation_coordination'. BE, HR, SI and LT did not report on the cooperation's fields. One MS (FI) provided a list of the cooperating countries for monitoring D1C6 (DE, DK, EE, LT, LV, PL, SE) and indicated that the monitoring programmes are carried out under the coordination of Helsinki Convention (HELCOM) for data collection.

The 'RegionalCooperationImplementation' field was reported by 9 MS (Table 90).

Table 90. Number of MS reporting for the regional cooperation implementation for D1C6.

	BAL						BLK	MED				NEA			
	EE	**FI**	**LT**	**LV**	**PL**	**DE**	**RO**	**HR**	**IT**	**SI**	**FR**	**NL**	**BE**	**DE**	**FR**
Not reported			1					1	1	1			1		
Agreed data collection methods											1				1
Common monitoring strategy					1		1								
Coordinated data collection	1	1		1		1						1		1	
Joint data collection											1				1

Figure 98 reveals that the MS consistently apply the same method for each parameter, which is a substantial basis to further harmonise PH monitoring. This is partially caused by the fact that most monitoring programmes are established by common policy obligations (namely WFD and RSC indicators).

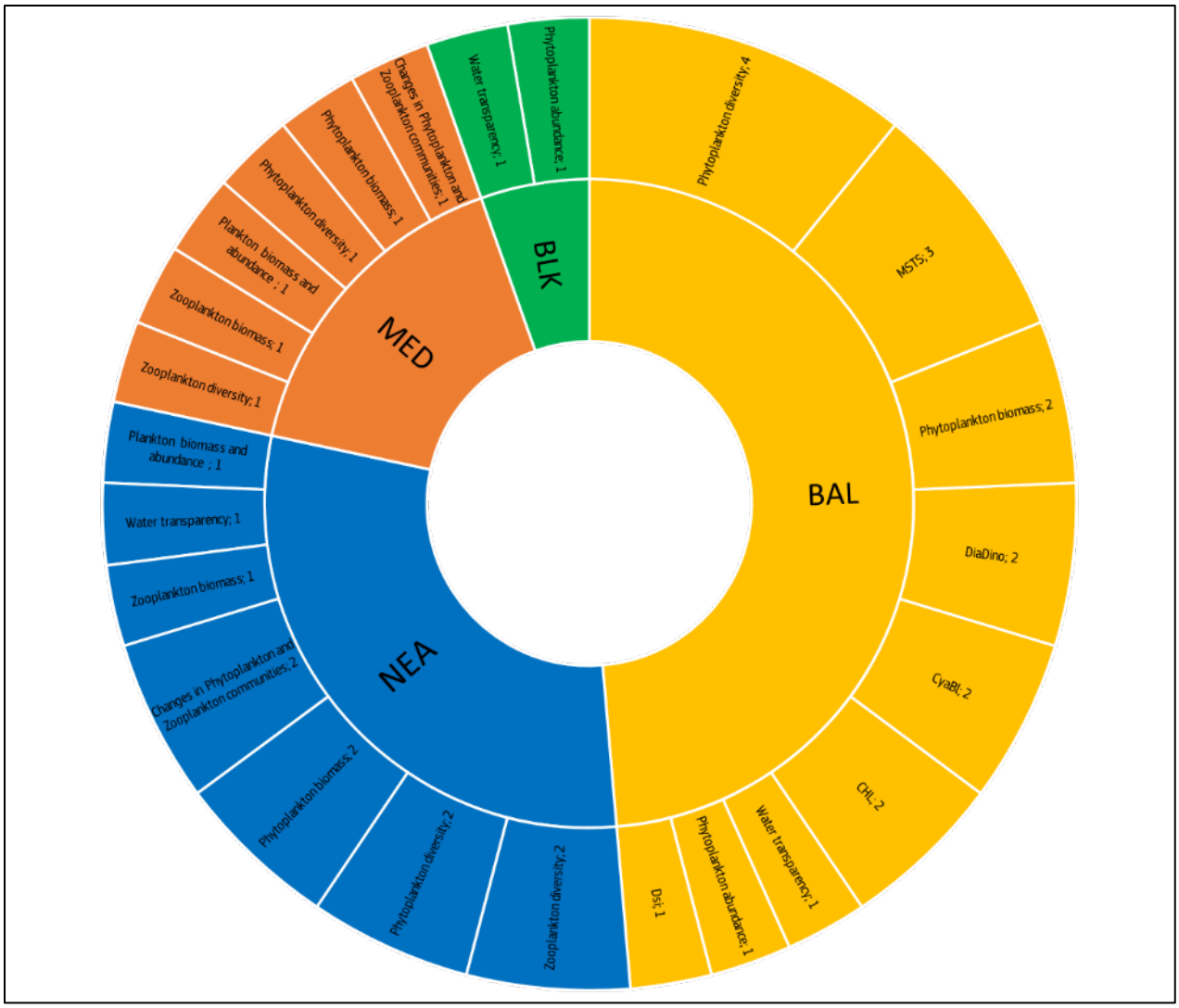


Figure 98. Number of MS reporting on common "'RelatedIndicators' for D1C6 elements across marine regions.

D4

The 'Regional cooperation implementation' field has been reported by 6 MS for D4C1 (DK, EE, ES, FI, PL, SE) and D4C3 (DK, ES, FI, NL, PL, SE), and by 5 MS for D4C2 (DK, EE, ES, FI, SE) and D4DC4 (DK, EE, ES, FI, SE) (Table 92). All the MS reporting on this field perform the monitoring across the Baltic and the North East Atlantic regions, referring to HELCOM and OSPAR, respectively.

Table 91. Level of implementation of D4 monitoring programme and coordination among MS within the same region.

	Agreed data collection methods				**Common monitoring strategy**				**Coordinated data collection**				**Joint data collection**			
	BAL	**BLK**	**MED**	**NEA**	**BAL**	**BLK**	**MED**	**NEA**	**BAL**	**BLK**	**MED**	**NEA**	**BAL**	**BLK**	**MED**	**NEA**
D4C1	FI, PL, SE			DK, ES					EE, FI, SE				SE			
D4C2	FI, SE			DK, ES					EE, FI, SE				SE			NL
D4C3	SE			DK, ES				ES	EE, FI, PL, SE				SE			
D4C4				DK, ES					EE, FI, SE							

D6

Table 92. Number of MS reporting for the regional cooperation implementation for D6 criteria.

	Agreed data collection methods				Common monitoring strategy				Coordinated data collection				Joint data collection			
	BAL	**BLK**	**MED**	**NEA**	**BAL**	**BLK**	**MED**	**NEA**	**BAL**	**BLK**	**MED**	**NEA**	**BAL**	**BLK**	**MED**	**NEA**
D6C1	1	0	1	2	1	0	0	0	3	0	0	1	1	0	0	0
D6C2	2	0	1	3	1	0	0	0	3	0	0	2	1	0	1	1
D6C3	1	0	1	2	0	0	2	1	1	0	1	1	1	0	1	1
D6C4	0	0	0	1	0	1	2	1	2	0	1	1	1	0	0	0
D6C5	2	0	0	2	3	1	2	1	6	0	1	2	1	0	0	0

5 Coherence with other policies

In addition to the MSFD, MS should state to which other EU policies and international agreements (including RSC), the monitoring programme contributes. This section highlights whether monitoring is or is not coherent with relevant directives and regional monitoring programmes, according to what MS have reported under the 'OtherPoliciesConventions' reporting field. The list of Directives and Conventions ('DirectivesConventions_Enum') is provided in the monitoring reporting guidance. Blank entries have been omitted. For those MS that have reported mixed subregions (DK, SE - BAL/NEA; ES – MED/NEA) the programmes have been (unless otherwise specified) repeated for each of their subregions, with the exception of those that can be clearly attributed to the Baltic, Atlantic and Mediterranean regions.

D2

European policies such as the WFD and the IAS Regulation are linked to the monitoring programmes in the BAL and NEA regions. In addition, international initiatives, i.e., IMO-BWM, and coordinated environmental programmes from the RSC are common across MS. In the Black Sea, the Habitat Directive is the main EU policy.

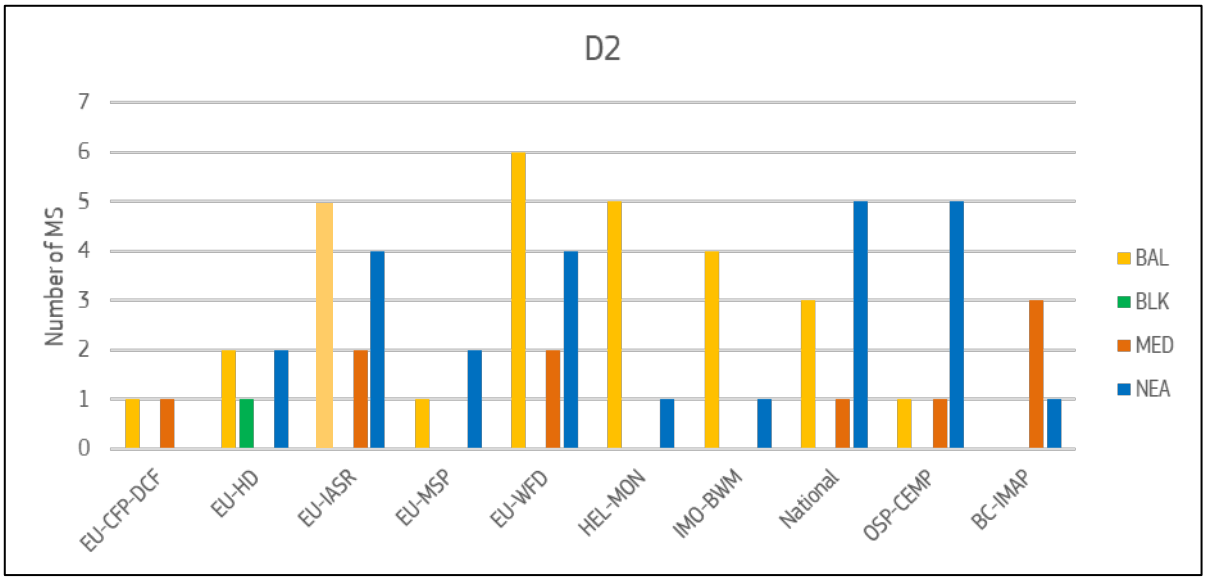


Figure 99. Number of MS reporting links to other relevant EU or international programmes for D2.

D3

17 out of the 18 MS (all but SI) reported linkages to other EU or international programs under 'OtherPoliciesConventions'. Often, multiple programs were mentioned in a single cell, separated by commas. All 17 MS mentioned correctly the main monitoring program for commercial species 'EU-CFP-DCF' (i.e., the Data Collection Framework of the Common Fisheries Policy), either on its own or in combination with other programs. Other than 'EU-CFP-DCF', which was the most frequently reported program in all regions, the most frequently reported programs were 'HEL-MON' and 'OSP-CEMP' (Figure 100). Notably, eight programs were only mentioned by 1 MS, namely 'ICCAT' and 'GFCM' (ES), 'EU-BD' and 'CWS-MAP' (DE), 'EU-MSP' (SE), 'EU-WFD' (FI), 'NFC' (IE) and 'BS-IMAP' (RO). Other than the single reference to 'BS-IMAP', which is due to RO being the only MS reporting from BLK, the other single references indicate poor harmonisation within the subregions of the MS reporting them. Additionally, some of these single references are possibly wrong as the relevant programs do not seem relevant to D3 (e.g., EU-BD, EU-WFD, EU-MSP).

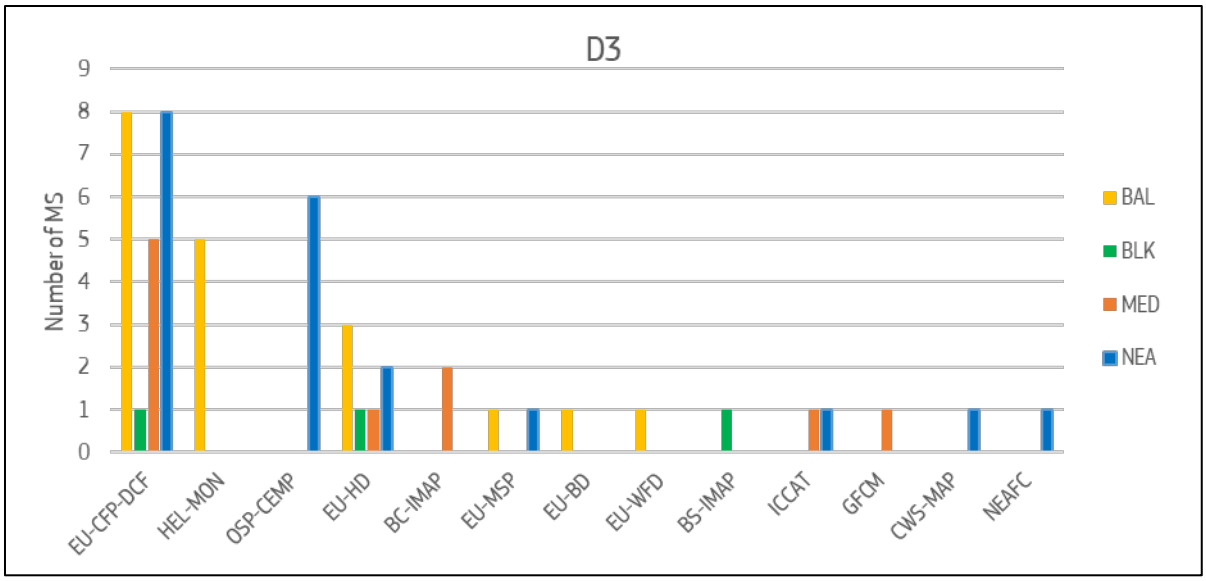


Figure 100. Number of MS reporting links to other relevant EU or international programmes for D3. 'National' entries have been omitted.

D5

The EU WFD is the most common policy reported by MS across the marine regions. Five MS reported links to OSP-CEMP programme within the NEA region, 6 MS reported for HEL-MON programmes within the BAL region. In the MED the BC-MAP programme was reported by 5 MS (Figure 101).

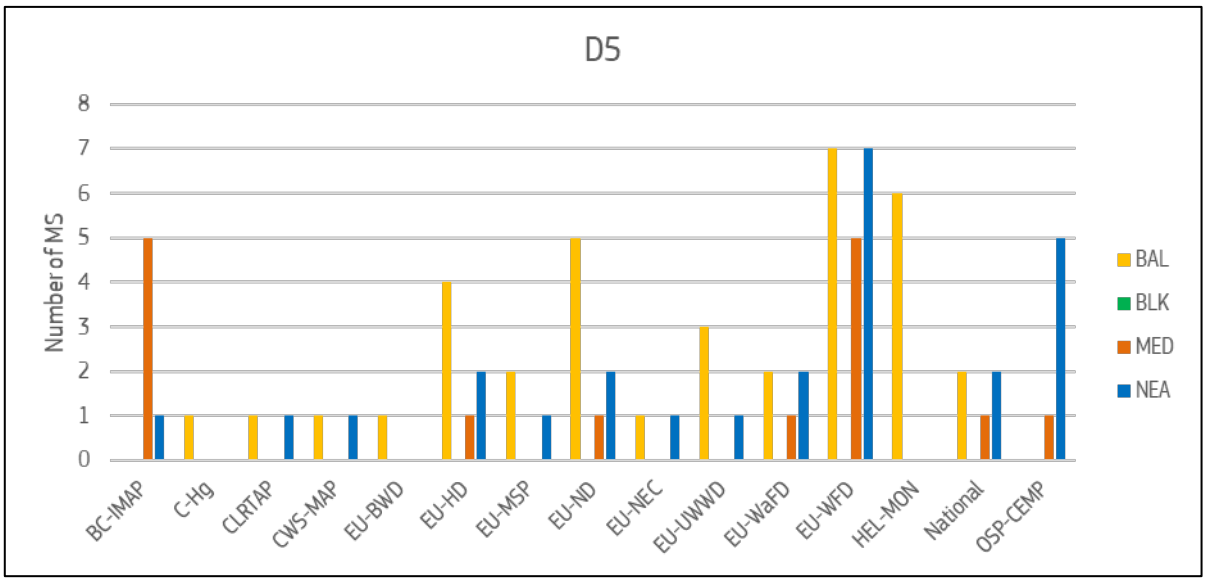


Figure 101. Number of MS reporting for OtherPoliciesConvetions across the regions for D5.

D7

Monitoring programmes indicated by MS are mostly related to other relevant EU or international policies and conventions, although a small number of MS also indicated national policies as relevant for D7 monitoring, and the link to international programmes is not always clearly defined. However, the most relevant EU legislative framework linked to D7 is undoubtedly the EU WFD, which was indicated by at least half of MS (BE, CY, DE, EE, ES, FI, FR, HR, IE, LT, LV, SE) within each marine region, followed by RSC such as HEL-MON, indicated by 5 MS within the BAL region (DE, DK, LT, LV, SE), and the OSP-CEMP, indicated by 6 MS within the NEA region (DE, DK, ES, FR, IE, SE) (Figure 102). Other relevant policies listed by MS included the EU-Habitat Directive, EU-Environmental Impact Assessment, and EU-Marine Spatial Planning directives.

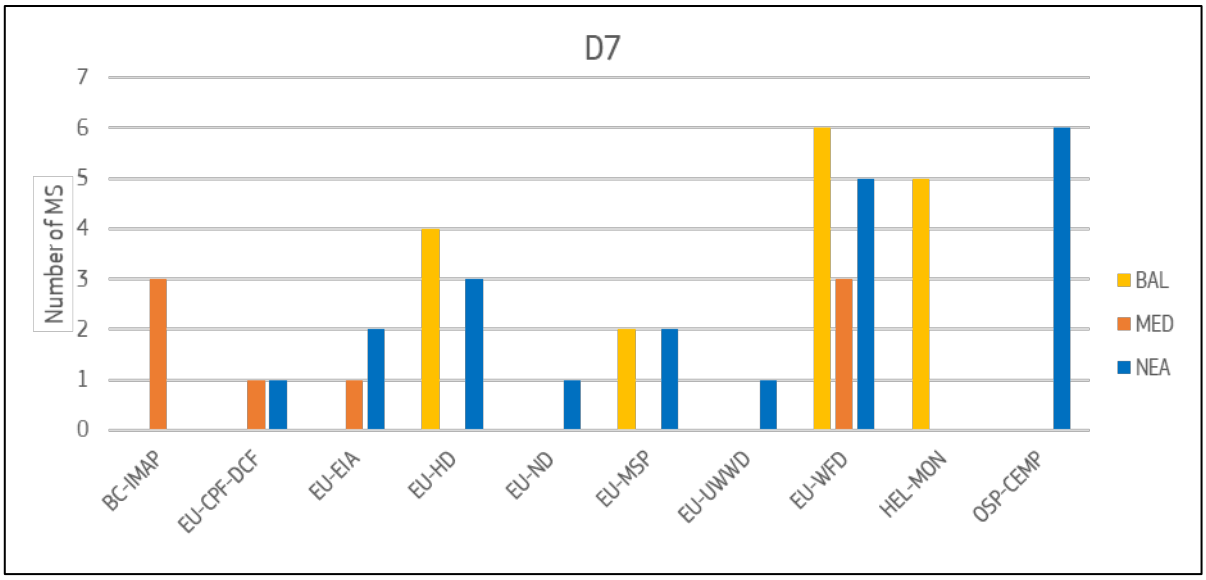


Figure 102. Number of MS reporting links to other relevant EU or international programmes for D7.

D8

D8 monitoring is mostly related to the WFD. OSPAR and HELCOM monitoring is also mostly indicated by MS in the Atlantic and Baltic regions, respectively. There is also harmonisation in the consideration of Bonn Agreement by most OSPAR countries. There are many other directives/conventions indicated by MS, but usually they are reported by only 1 or 2 MS (Figure 103).

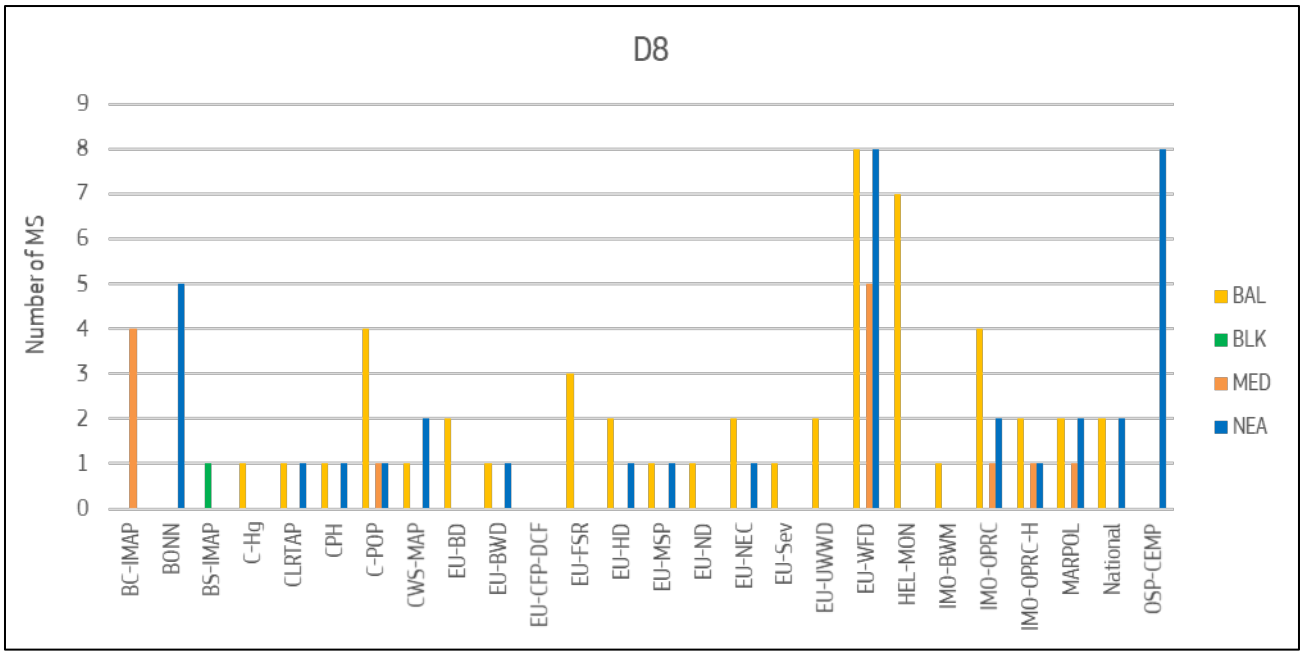


Figure 103. Number of MS reporting links to other relevant EU or international programmes for D8.

D9

As seen in Figure 104, monitoring in most MS in the Baltic (DK, EE, FI, LV, PL, SE) and Atlantic (BE, DK, ES, IE, NL, SE) regions is coherent with the EU Food Safety Regulation. There is only partial coherence across MS in those marine regions in relation to other EU directives (WFD) or regional programmes. In the Mediterranean, there is no coherence in the reporting regarding policies or conventions related to this descriptor.

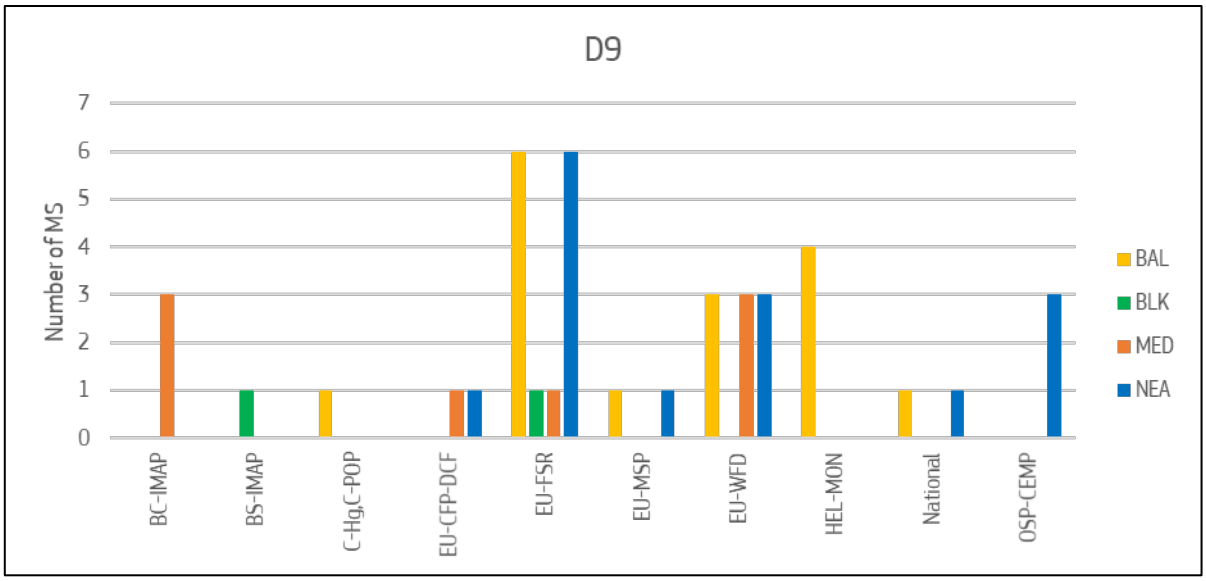


Figure 104. Number of MS reporting links to other relevant EU or international programmes for D9.

D10

As seen in Figure 105, OSPC-CEMP in the NEA region (BE, DE, DK, ES, FR, IE, NL, SE) and HEL-MON in the BAL region (DE, DK, EE, FI, LT, LV, SE) are the most frequently reported programmes. Only 3 MS (RO, PL, SI) did not reported linkages to other programmes. Additionally, multiple international programmes were reported in a single reporting cell, hindering the analysis.

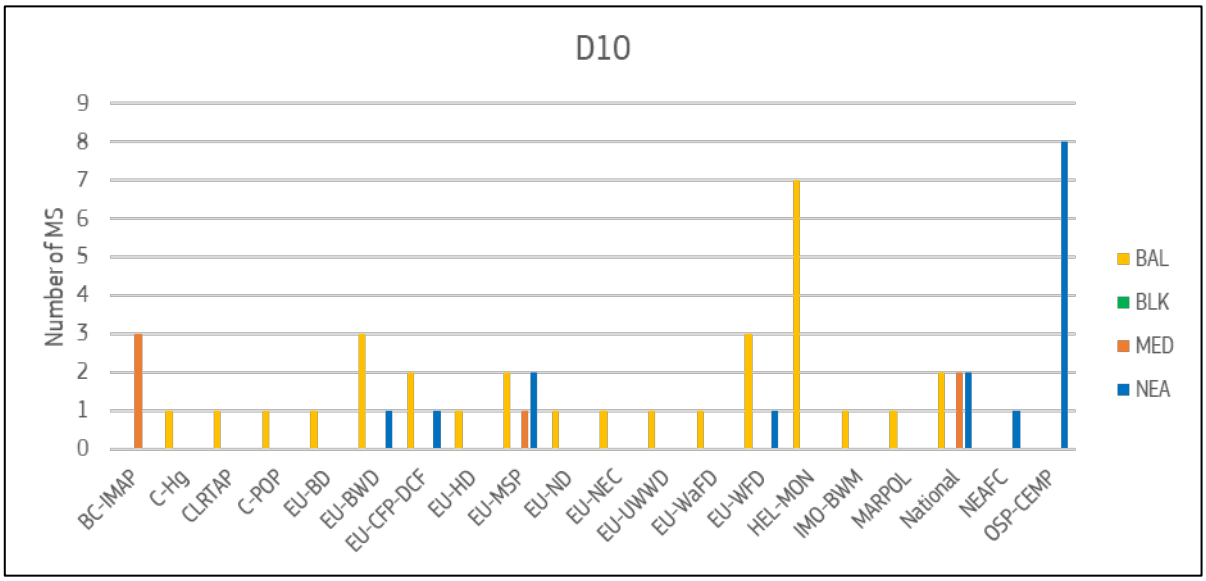


Figure 105. Number of MS reporting links to other relevant EU or international programmes for D10.

D11

Several MS indicated other policies and conventions relevant to D11 monitoring. The EU EIA, EU HD, EU MSP, BC IMAP, HEL MON, and OSP CEMP were the EU and international/regional programmes listed by at least one MS as relevant for D11C1 and/or D11C2 monitoring (Figure 106). Moreover, 2 MS (IE, LV) indicated the EU BD as relevant for D11C1, and the EU WFD was indicated by another MS (SE) as relevant for D11C2 monitoring. Few MS indicated with a higher level of detail the link between D11 monitoring under the MSFD and other programmes. More specifically, DE indicated that the environmental status under D11 is monitored on the basis of the obligation to report impulse noise events to the noise register established by OSPAR and HELCOM; EE indicated that ambient continuous noise is measured and the soundscape is modelled in cooperation with other HELCOM parties; PL stated that D11 monitoring is regionally coordinated based on the output from the BIAS

project and HELCOM; and BE mentioned the existence of an impulsive noise register at OSPAR level. Other international policies were indicated by MS that addressed features not listed under D11C1 or D11C2, namely C-Hg, CLRTAP, C-POP, EU-BWD, EU-CFP-DCF, EU-ND, EU-NEC, EU-UWWD, IMO-BWM (all of them were indicated by EE and are not included in the figure).

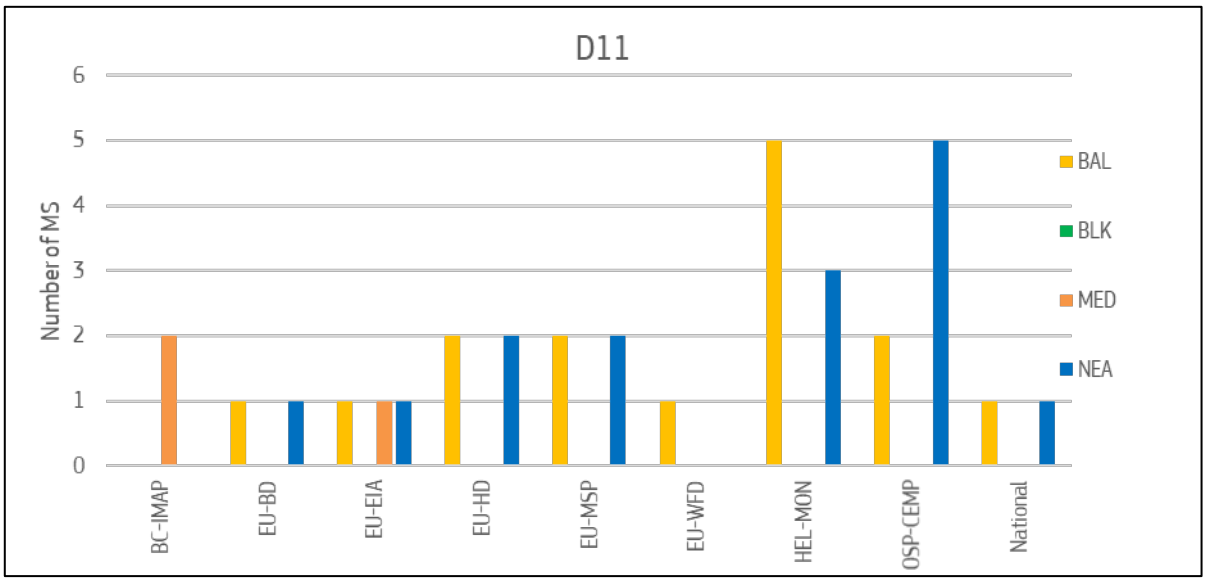


Figure 106. Number of MS reporting links to other relevant EU or international programmes for D11.

D1-Marine Mammals

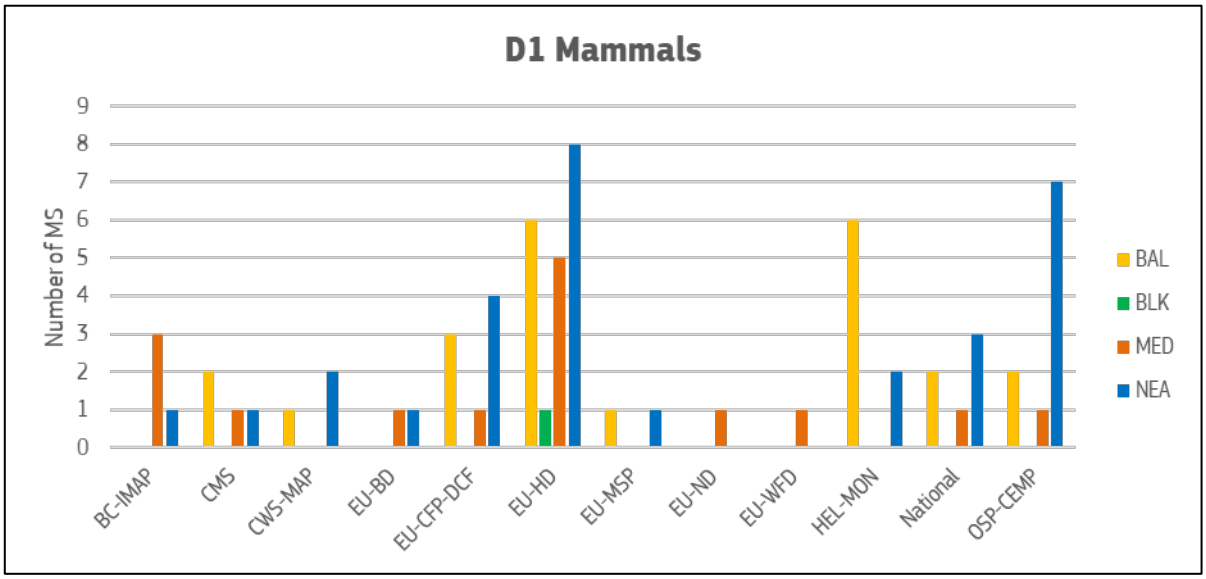


Figure 107. Number of MS reporting links to other relevant EU or international programmes for D1 – marine mammals.

D1-Marine Reptiles

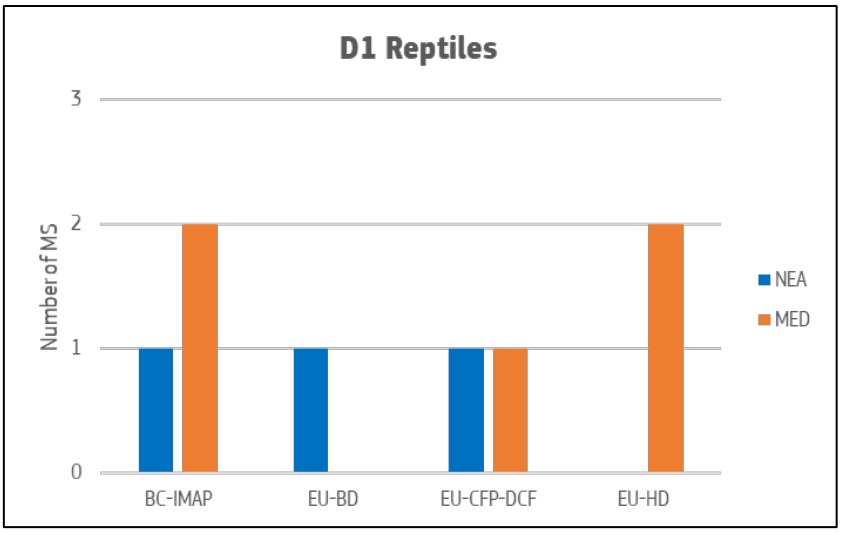


Figure 108. Number of MS reporting links to other relevant EU or international programmes for D1 – marine reptiles.

D1-Fish and Cephalopods

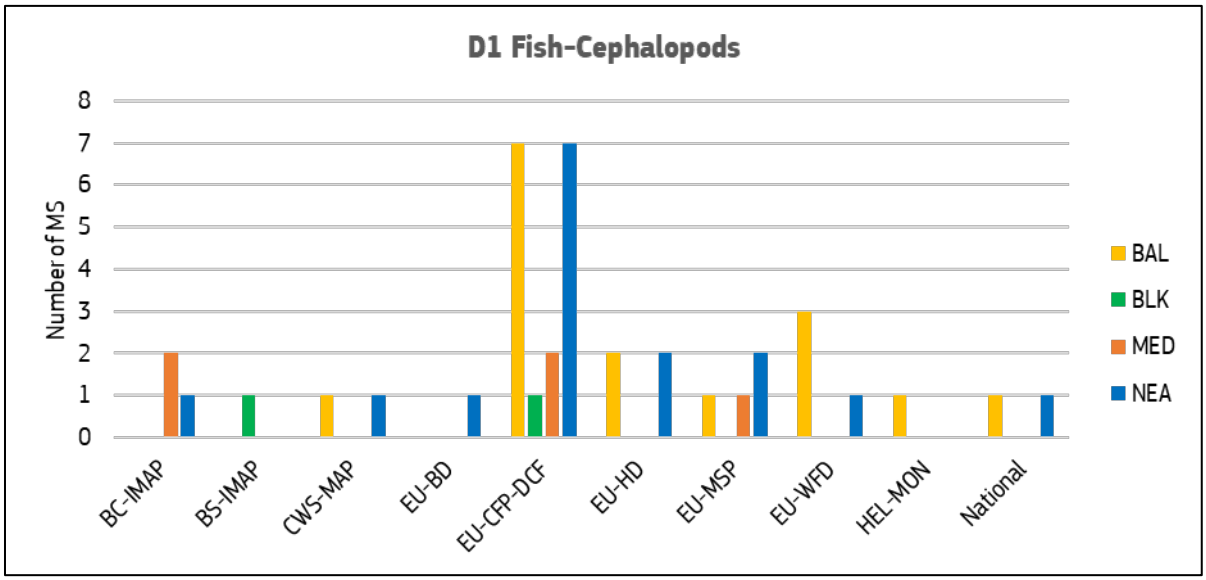


Figure 109. Number of MS reporting links to other relevant EU or international programmes for D1 – fish and cephalopods.

D1-Seabirds

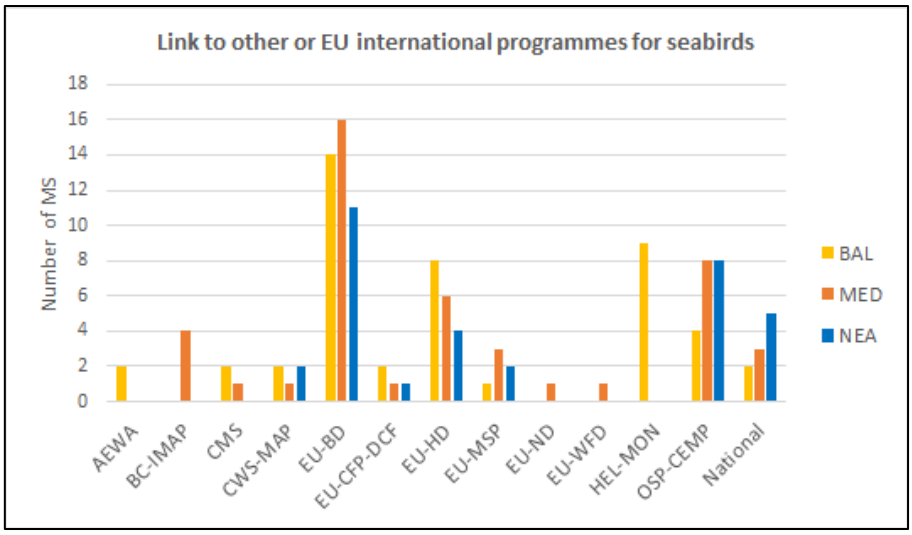


Figure 110. Number of MS reporting links to other relevant EU or international programmes for D1 – seabirds.

D1-Pelagic Habitats

The WFD was indicated by 10 MS. SE and DE reported links to 4 international programmes which are: OSP-CEMP, HEL-MON, EU-WFD, EU-MSP and CWS-MAP, EU-WFD, HEL-MON, OSP-CEMP respectively. ES is the only MS from the MED region reporting for BC-MAP. OSP-CEMP and HEL-MON were indicated by 5 MS each from the NEA and BAL regions. Three MS (PL, BE, SI) did not report any EU or international programmes.

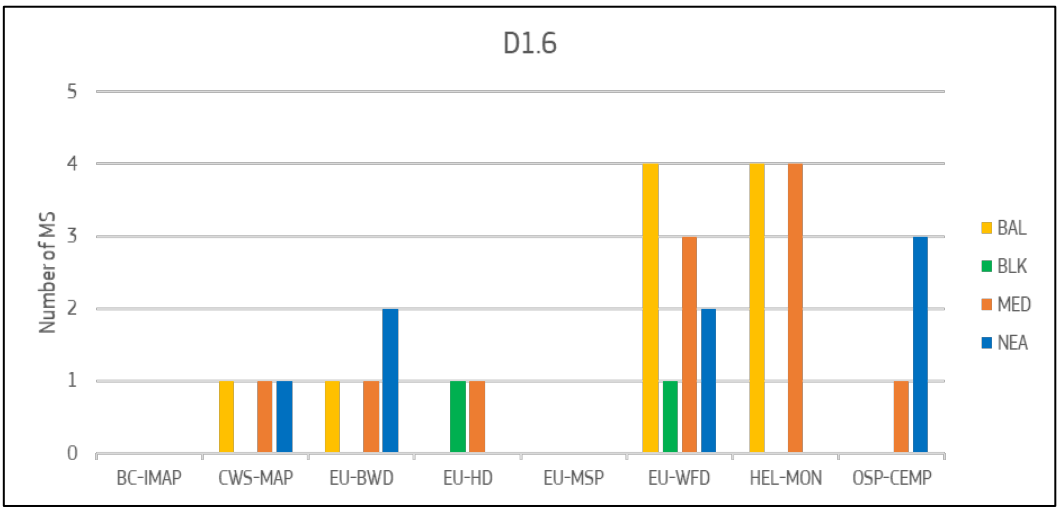


Figure 111. Number of MS reporting links to other relevant EU or international programmes for D1 – pelagic habitats (ES and SE not included).

D4

Fifteen out of 16 MS reported for a total of 23 international programmes. Within the Baltic Sea, the HEL-MON is mostly applied (7 MS: DK, EE, FI, LT, LV, PL, SE), followed by the EU-WFD (6 MS: DK, EE, FI, LT, PL, SE) and EU-BD (5 MS: DK, EE, FI, PL, SE). Within the Mediterranean Sea, the EU-WFD and EU-HD are the mostly applied with 4 MS (HR, ES, FR, IT) and 3 MS (CY, ES, FR), respectively, while in the NEA region, OSP-CEMP is applied by 4 MS (BE, FR, ES, IE), followed by National programmes (4 MS: BE, FR, ES, IE), and EU-BD, EU-HD and EU-WFD (3 MS: BE, FR, ES). The EU-CFP-DCF is applied by almost all MS reporting on this field (13 MS: BE, CY, DK, EE, HR, ES, FR, FI, IE, IT, NL, PL, SE). In the Baltic Sea, there are sixteen international monitoring programmes reported by MS and two national programmes, whereas in the MED and NEA there are 11 and 16, respectively, international programmes and 2 and 4, respectively, national programmes reported (Figure 112).

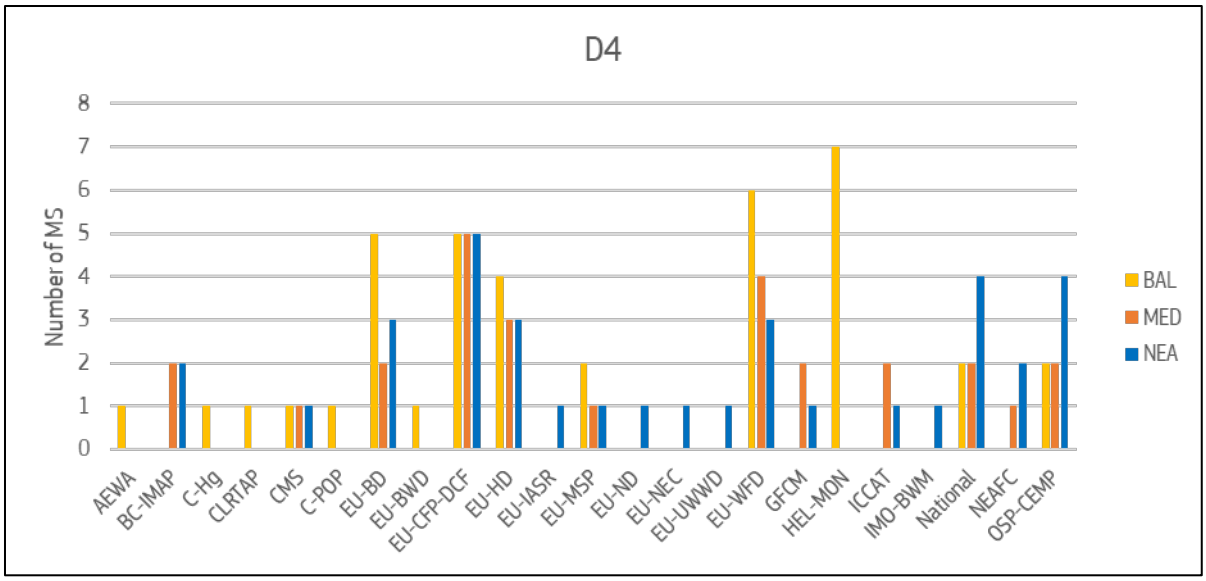


Figure 112. Number of MS reporting links to other relevant EU or international programmes for D4.

D6

MS considered the established monitoring programmes for the regional indicators, mostly from HD, WFD, HELCOM and OSPAR (Figure 113).

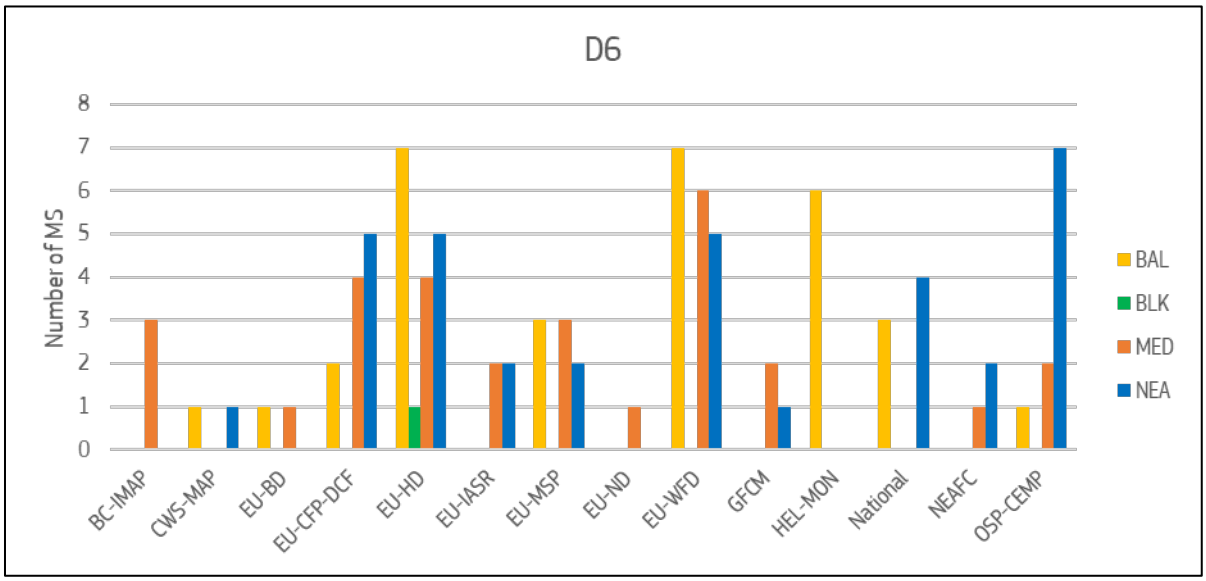


Figure 113. Number of MS reporting links to other relevant EU or international programmes for D6.

6 Future monitoring

This section analyses the gaps and plans as reported by MS under the 'Gaps_Plans' reporting field. The assessment of the gaps described is difficult due to many MS reporting in their national languages.

D2

Of the 18 MS reporting, DK declared a sufficient monitoring programme for D2, and RO and SI did not report information related to gaps and gap plans. CY stated "The Republic of Cyprus has requested an exemption to a program of measures with regards to NIS, due to the fact that the primary source of NIS to the region is the unaided introduction through the Suez Canal, a major structure beyond the control of the EU, rendering any measure inapplicable (DFMR, 2016). Concomitantly with that request, no targets have been set for any of the NIS indicators".

Taxonomy expertise is listed among the gaps reported by BE and HR. The lack of standardized monitoring methodologies is highlighted by HR, NL and SE, whereas inadequate geographical extent of the monitoring, low and irregular frequency of the sampling are gaps reported by SE, BE and EE, respectively. ES reported a lack of indicators in monitoring NIS. EE highlighted that hull fouling and aquaculture are not included in the NIS monitoring. Among the plans for improving NIS monitoring, FR an IE indicated harmonised monitoring among MS. IT HR, SE pointed on new technologies for improving monitoring, for example, genetic analysis for monitoring the presence of NIS. Ports will be monitored in IT and LT because considered hotspot of NIS introductions. SE will plan the monitoring accordingly to the indications provided by ecological models. SE and LV planned the public participation for NIS monitoring with Apps for species ID and citizen science projects.

D3

8 MS (CY, DK, EE, LT, LV, NL, PL, SE) reported no gaps in their D3 monitoring. From the rest, certain MS reported some shortcomings in the coverage of certain species/stocks (DE, FI, IE, HR) or fleet segments (BE). Notably, some MS described gaps but no plans (BE, FI, HR), while, conversely, some others offered general descriptions of management plans/targets without mentioning specific gaps (RO, SI, FR, IT).

D5

Ten out of 18 MS presented plans to overcome the reported gaps in a coherent way. BE, DK, SI, CY reported no gaps and, consequently, no plans were detailed by those MS.

ES listed several gaps in the monitoring programmes, but did not provide details on the plans to overcome them. PL did not report on this field and IT compiled the field with information for other fields such as 'CoverageTargets', 'RelatedTargets'. EE provided information on the lack of knowledge linked to inland inputs, but did not report plans to address this gap. New technologies are commonly cited by MS within the plans to overcome the listed gaps. Remote sensing, ecological modelling, ferry boxes and new indicators or adapted indicators to the specificities of the area, are mostly reported by MS (SE, LT, DK, FR). Harmonisation and coordinated monitoring is also cited by FR, NL and IE. The request of more funds is listed among the plans by HR and LT. In SE, improvements are planned to monitor the input of phosphorus via atmospheric deposition as P emissions and deposition are not covered by the CLRTAP or E-PRTR.

D7

The majority of MS either indicated that there are no or limited gaps in their monitoring programmes (FI, LV, BE, NL, HR, IT), or that the monitoring currently in place is sufficient to cover at least one of the two D7 criteria (DE, DK, ES for D7C1 and RO for D7C2), or to monitor the descriptor criteria at least within certain spatial scopes (IE for in-shore and offshore areas). Indeed, most MS (13 MS) stated that adequate monitoring is already in place for this descriptor (Figure 74 above). However, from the analysis of reported information, several MS failed to identify relevant targets and/or measures for this descriptor, and, for those doing so, the progress towards their coverage is still limited.

Moreover, some MS explicitly identified a number of issues hampering D7 monitoring, either for the whole descriptor or for a specific criterion and/or feature. Issues identified by MS were related with a few main aspects that can be broadly categorized in:

Practical constraints: The possible existence of local gaps caused by technical defects or damages in the long-term recording systems was highlighted by DE.

Lack of long-term data and information: EE indicates the lack of monitoring stations and field measurements for data validation, CY the necessity to reactivate long-term monitoring programmes, IE the lack

of available data related with the conditions prior to the development of coastline structures, and HR the limited spatio-temporal resolution of some measurements.

Access to data and their management: FR highlights the difficulties in accessing data and information as well as the necessity of knowledge sharing and data coordination. This last issue was also mentioned by DK.

Lack of common indicators: The lack of established indicators for assessing D7 criteria at regional level is indicated by EE, LT and FR. FR also indicated the lack threshold values and CY the need to develop a comprehensive environmental sensitivity index of the coastline.

Lack of knowledge on local and cumulative effects/impacts: SE mentioned the lack of a follow-up of local effects derived from human activities, in parallel with WFD management, FR the need to assess the relation between activities and pressures, and their impact on the marine environment and HR the difficulties related with the assessment of cumulative effects of minor impacts.

Need for an improved coordination among monitoring programmes: FR mentioned the general need of coordination with other monitoring programmes both at national and regional level.

D8

The information reported on gaps is sometimes too generic and focused on the description of the current monitoring activities (e.g., FR refers to the need to maintain the acquisition of data on contaminant concentrations and define operational sampling strategies responding to the specificities of marine sub-regions, LT indicates the kind of studies used for HELCOM assessments, and RO indicates that the continuity of monitoring of contaminants should be kept). 2 MS (FI and NL) indicate there are no monitoring gaps for D8. Moreover, gaps are not properly described under the 'gaps-plans' reporting field by IT (which reports instead the coverage of targets) and SI (which focuses on the different measures relevant to D8).

Nevertheless, specific gaps have been also identified, although often they are more assessment gaps than monitoring gaps. Furthermore, clear plans to address them are indicated only in few cases. The gaps reported by MS are compiled below, grouped by relevant categories:

Data: Data/information logistic gaps have been reported by CY, EE and LV. For instance, CY indicates the need to incorporate available data into a central database to calculate baseline concentrations for the contaminants investigated. EE mentions the need for collecting data from secondary pollution (e.g., dredging and dumping works) into a public database.

Frequency and spatial scope: EE specifies that the monitoring frequency in coastal areas does not provide enough data for the HELCOM assessments. This country also mentions the need to analyse the structure of the national hydrochemical monitoring programme of rivers, including its spatial and temporal scope, in order to ensure sufficient data for reliable assessment of contaminants load from land-based sources. ES reports that coastal monitoring is fundamentally based on the data generated in compliance with the WFD, which differs in the frequency and intensity of sampling leading to non-homogeneous information within the same Demarcation. Inadequate frequency and spatial scope is also highlighted by LV, without specifying the gaps, but indicating that deficiencies will be solved by 2024.

SE highlights the need for increased monitoring in more polluted areas and also a need for improved quality in all steps from planning, sampling and delivery to data host so that more data can be used in the assessment. The need to improve monitoring in open-sea areas and approaches to address offshore risks are indicated by EE and IE.

Contaminants/thresholds (D8C1): Gaps in relation to the selection of contaminants are reported by DE (which also specifies the substances: pharmaceuticals and personal care products and biocides for the EEZ) and HR. The need to develop thresholds values for contaminants is also reported by EE, HR and IE. IE also highlights the need for consistency between WFD EQS and OSPAR assessment criteria and that the potential impact of cumulative effects of contaminants is unknown. SE indicates that current screening projects within OSPAR and HELCOM may help identify new harmful substances in the marine environment.

Effects of contaminants (D8C2): The lack for criteria and methodological standards regarding biological effects monitoring is indicated by HR. FR provides clear plans to address it and define an operational monitoring strategy concerning the effects of contaminants in marine organisms, which includes the identification of problematic areas to be monitored and the improvement of data access for non-operational tracking devices, in particular regarding metadata. PL reports the needs for extending the scope of research on biological effects with new indicators (without further explanation). Moreover, SE mentions the increased efforts for improving

the monitoring of the effects of hazardous substances (e.g., increased number of sampling sites and variables monitored, improvement of reporting data, and plans to optimize coverage and costs) as well as recent projects to develop new monitoring of the health status of marine mammals. IE indicates concerns about the potential for environmental harm associated with the substitute chemicals, such as copper based paints used to replace tributyltin (TBT) in antifouling paints.

Significant pollution events (D8C3): HR and FR highlights the lack of agreed methodological standards for "significant acute pollution events" and FR also mentions the need to adapt their subprogramme in order to meet MSFD needs. IE indicates that, so far, the extent and volume of detected spills is not calculated, but a recently developed procedure will allow for the collection of data on the volume and extent of future spills.

Effects of pollution incidents (D8C4): Gaps in relation to the monitoring requirements in the event of pollution incidents are indicated by BE, DE, and DK. EE mentions the development of the indicator "Proportion of oiled birds" for the assessment of the impact of significant acute pollution events, but that has not been applied in the D8 assessment yet (there is no information on when it will be applied). Also FR indicates the needs to improve the quality of data from the monitoring of stranded birds. DK, instead, mentions that plans to address monitoring activities in connection with acute pollution incidents will be drawn up in the coming monitoring period. Moreover, ES indicates that adequate follow-up of D8C4 is still under development, but there are clear plans to deal with it (e.g., by drafting a Guide for action against oiled fauna, in coordination with the Autonomous Communities). SE indicates that currently there is no full-scale monitoring in place for monitoring the effects of possible oil spills, but mussels are collected in a reference network, approximately every five years, to enable analysis of oil related substances before and after a spill.

D9

Several MS (BE, DK, FI, IT, LV, NL, PL) have indicated that there are no gaps in relation to D9. Other MS have identified some gaps and plans for this descriptor. For instance, CY acknowledges there is only partial D9 coverage and plans to extend the monitoring to more contaminants, species and areas. IE highlights the limited contaminants and matrices regulated under Food Regulation as well as the limited number of species for which data are available. This country indicates the ongoing plans to address those gaps, by targeting species for which there is limited data and evaluating additional contaminants to support the evaluation of risks for consumers and assist in setting future limits. RO also plans to expand the number of samples and species. EE indicates the need for regular annual seafood safety monitoring for substances that exceed the threshold values. And SE indicates that the data from the ongoing monitoring of hazardous substances in biota under D8 can be used to support the Swedish Food Agency's risk assessment, for which appropriate conversion factors between tissues are needed. ES highlights the need to improve the traceability of the samples as well as the understanding of the links between the levels of contaminants in fishery products evaluated through Food Safety monitoring and the MSFD assessments of environmental pollution. FR, although indicates that the monitoring set up during the first implementation cycle is overall operational, proposes several plans to improve monitoring and sampling strategy, including the centralization of datasets and the improvement of the data quality for a better understanding of the precise location of the geographical fishing area. SI refers to the need for improving the measures to be taken for the control of the concentrations of contaminants in fishery products.

D10

The assessment of the gaps reported by MS sometimes provided general descriptions related to the coverage of targets, measures or plans without mentioning specific gaps. In this context, IT and CY reported the coverage of targets and the status of the programmes instead of information relevant to gaps in monitoring programmes, respectively, and SI focused on measures relevant to D10. Moreover, 2 MS (FI and HR) indicate there are no monitoring gaps for D10. However, some MS have reported specific gaps on the following criteria:

Primary Criteria: Gaps in relation to the spatial coverage in certain environmental compartments in the assessment of macro and microlitter are often reported by MS (BE, DE CY, DK, EE, IE, SE), but some of them are testing methods, and developing projects and plans to cover the missing aspects or compartments (e.g., DE, SE). NL and SE reported the lack of an agreed method that would allow assessment in the seabed compartment. RO also indicated the need to improve frequency and monitoring transects in the BLK region.

Secondary Criteria: The gaps related to the secondary criteria mainly focused on the lack of methodological standards at regional and/or EU level. FR also indicates the effort to extend the spatial coverage and the assessment of litter to additional species. However, other MS are still developing monitoring and assessment plans, but will be included in the coming monitoring periods (e.g., BE, ES). SE indicated that marine litter is

currently not considered a major problem in relation to the impacts to marine animals and the results of their research do not justify continuous monitoring so far.

D11

A few MS indicated that their monitoring programmes are sufficient and there are no or limited gaps (DK, FI, BE, NL). However, most MS identified gaps in the implementation of monitoring underwater noise and stated that adequate monitoring will only be in place by 2024.

The main issues hampering monitoring programmes identified by MS were related with a few main aspects that can be broadly categorized in:

Lack of long-term data and information: The lack of long-term measurement programs that prevent from the assessment of trends is highlighted by DE and ES. EE indicates the scattered monitoring stations and lack of field data to validate models.

Difficulties in accessing data and information: SE mentions issues related with the military and private companies being granted for providing information on their noise-producing activities and FR the lack of integration of sources of data other than research (e.g., from the impact assessment studies, opportunistic data etc.).

Lack of common indicators and threshold values: The lack of threshold values to assess related indicators is highlighted by EE and IE specifies the need for agreed thresholds at population or ecosystem level. LT and NL indicate this is mostly due to the unknown effects of noise on marine species, while NL refers to the absence of criteria for assessing forms of energy other than noise.

Need for standardization and coordination: The lack of a standardized process or coordinated approaches for data evaluation is mentioned by DE and SE.

Delays in national law implementation: HR indicates the lack of integration into national law (i.e., requiring the adoption of a register for underwater impulsive noise).

D1-Marine Mammals

Two MS did not provide or misreported information regarding the 'Gaps_Plans' field (IT, PL). 3 MS (FI, LV and DK) reported 'no gaps' in their monitoring programmes. The problem of monitoring and assessment of incidental bycatch of marine mammals (D1C1) was reported by the vast majority of MS (BE, HR, EE, ES, FR, IE, NL, RO, SE, SI and LT). To overcome this gap, MS are planning to adjust international coordination (BE), extend on board observers program (ES, SE and FR), install cameras on board (SE, FR), employ standardized observation (ES, IE, NL, RO), assess the impact of construction nets on mammals and propose measures to regulate or reduce fishing efforts (LT, EE, SI). FR is planning to improve monitoring of species that are not clearly visible offshore (great divers). In particular, FR will continue the development of passive acoustic monitoring using autonomous recorders (hydrophones) by completing the network of acoustic observatories.

Many MS (LT, FR, ES, EE, SE and IE) indicated the need to assess interactions between human activities and pressure on mammals, in order to meet the needs of the MSFD. The objective will be to improve the OBSMER system on the fisheries, sectors and fishing gears most at risk (e.g., gillnets, longlines) and to support the implementation of innovative techniques (on-board cameras, etc.) complementary to the embarkation of observers. SE suggested that, by improving monitoring of different human activities and pressures, the aim is to use these data together with data on mobile species to be able to assess D1C5. FR and IE are planning to develop BEE indicators and threshold values associated with D1C5. 2 MS indicated insufficient data on the abundance (SE, BE). To overcome this issue, SE started using cameras from airplanes in several locations in order to improve the abundance calculations. For D1C3, the Lithuanian Maritime Museum is implementing a project in which the Baltic Sea Animal Rehabilitation Center will treat abandoned seal pups, injured seals in the Baltic Sea, and teach them how to live in freedom. There is also ongoing work in SE to improve and adjust the monitoring of health status of seals, including harbour porpoises. The aim is to be able to distinguish health issues caused by different pressures. These activities are carried out in close collaboration with other Baltic countries in the expert group HELCOM MAMA.

D1-Marine Reptiles

One MS (IT) misreported the field 'Gaps_Plans'. Four out of 6 MS (HR, FR, IE and ES) indicated the problem of incidental by-catch mortality. To overcome this issue, MS are planning to analyse the risks of incidental catch of turtles by different fishing gears (HR, FR), by using observers on fishing vessels (HR, FR, IE), by making obligatory the recording of bycatch and endangered species (FR), by implementing innovative techniques such

as on-board cameras (FR) and collaborating with professional fishermen (FR). 2 MS (IE, FR) are planning to improve the diagnosis of the death causes of reptile species by increasing the number of autopsies, systematize genetic and skeletal-chronological analyses, initiate a study on chemical contamination and strengthen the telemetric monitoring of sea turtles released by care centers. Coordinated efforts should be made to scientifically evaluate and test the methodologies used for the assessment of species behavior and habitat use. FR is planning to deploy HD image acquisition systems during aerial monitoring campaigns that could improve the identification of sea turtles. CY is planning to implement a more cost-effective sampling program that alternates yearly between field and eDNA sampling, which relies on the collection and analysis of water samples. HR is planning to conduct further research to assess the impact of pressures on populations of sea turtles. IE is planning to standardize observation, recording and reporting of mortality/injury interactions and set scientifically coherent threshold values for non-target species.

D1-Fish and Cephalopods

Two MS did not provide or misreported information on the "Gaps_Plans" field (IT, PL). 3 MS (FI, LV and DK) reported 'no gaps' in monitoring programme. Inconsistencies of partial monitoring of non-commercial species and by catch are the most frequent gaps reported by 10 out of 18 MS (DE, HR, CY, HR, ES, NL, RO, SE, IE and FR). To overcome these gaps, the MS are planning to increase monitoring regional monitoring assessments (FR, DE and SE), standardized observation (ES, IE), add cameras on board (SE and FR), and start to use practical cost-effective methods such as eDNA (CY, FR and IE) to detect non-target marine vertebrates around identified problematic interactions with fisheries. In addition, MS indicated the need to strengthen the links between the EU MS by promoting the establishment of "Joint Monitoring Programs (JMP)" based on international fishing campaigns (DE, ES, SE, IE and FR) and develop indicators and threshold values associated with all the criteria D1C1 – D1C5. 4 MS (FR, SI, NL and ES) indicated the lack of information for cephalopods and suggested monitoring programs for fish should extend to cephalopods. 2 MS (SE, LT) indicated that migratory fish are partly monitored using data from commercial fisheries. To overcome this issue, MS suggested further development of monitoring programmes and increasing sampling frequency. 3 MS reported a gap on the assessment of habitat condition (IE, ES and HR). To overcome this issue, MS must invest additional effort to find the most appropriate way to obtain relevant data or new methods to determine this criterion.

D1-Seabirds

Two MS did not provide information on the "Gaps_Plans" field (IT, DK). 2 MS (FI, LV) reported 'no gaps' in monitoring programme and an adequate monitoring in place by 2014 and 2018, respectively. Inconsistencies of by-catch mortality and impact of fishing are in general the most frequent gaps reported (8 MS). To overcome these gaps, MS are planning to create a by-catch registration database (LT, NL, SE, ES, IE), standardized observation (ES, IE, HR), increase regional monitoring assessments (DE, SE), add cameras onboard (SE) and create a coherent threshold value for non-target species (FR, IE). Another gap was no standardized trajectory of the monitoring (BE, ES) and no targets at national scale (DE, ES, LT). Less frequently reported are gaps on the assessment of habitat condition (PL), insufficient data on the distribution (CY, SE) and need for common standards at regional level to harmonise monitoring and assessment (CY). To overcome these gaps, the MS plan to activate more programmes and increase funding. For instance, ES

D1.6-Pelagic

Five MS did not provide information on the 'Gaps_Plans' field and one MS (FI) reported 'no gaps' and an adequate monitoring in place by 2014. Inconsistencies in temporal and spatial monitoring programmes are the most frequent gaps reported (DE, EE, HR, LT, NL, RO, SE). The need for common agreed indicators is also highlighted by 2 MS (BE, EE). The overcome these gaps, DE and NL planned to increase the monitoring areas by 2018 and 2024 ('Coverage_Targets'), respectively. EE, FR, SE and HR planned to invest in research for developing new sampling devices and analysis strategies. Ecological models, remote sensing and genomics analysis are the most promising technologies cited by MS for overcome the monitoring gaps (temporal and spatial inconsistencies, and taxonomic uncertainties).

D4

10 MS reported on the field 'GapsPlans'. Two of them (DK, FI) declared no gaps in the monitoring programmes and no plans for further improvements; 3 MS (SI, IT, PL) provided general overviews on the topic with no details on gaps and the plans to overcome them. Among the gaps identified by MS, the "lack of knowledge" on the food-web functioning, structure and variation under human pressures is the most frequently reported (ES, HR, LT, SE). The missing knowledge has consequences on missing indicators (ES, HR, EE) or not adequate indicators (SE) and on the impossibility of defining thresholds, reference values and defining GES (ES, HR, SE). The reported

plans for improving the monitoring in the future, point at developing a new indicator (ES, HR, SE) and improving the existing monitoring programmes (i.e., increasing the monitoring frequencies) (LT, SE).

D6

4 MS (ES, IT, RO, SI) did not provide relevant information on the gaps and the gap plans for improving the monitoring programmes and PL did not fill the 'GapsPlans' field. DK, NL and FI reported 'no gaps' in their monitoring programmes. The most frequently reported gaps include the inadequate spatial coverage of the benthic habitats and the lack of georeferenced monitoring information (CY, DE, EE, IE, LV, SE), the lack of standard methods i(HR, IE and LT), the lack of threshold values (HR and IE), and the lack of indicators (IE and EE). In general, SE reported a lack of data for a complete understanding of the spatial diversity of habitats and species distribution and BE and IE highlighted the difficulties of determining the effect of cumulative pressures on habitats and the difficulties of discriminating between the natural and the anthropogenic induced effects. In particular, IE declared that the monitoring of the adverse effects on benthic habitat is limited to fishing gears and does not cover all the gears. CY reported difficulties on developing a complete catalogue of species. Limited resources are also listed among the gaps by LT.

The plans to overcome the gaps include improving the ongoing monitoring programmes (BE and NL), the implementation of acoustic seabed data for habitat identification (BE) and the use of remote sensing for coastal benthic habitat (IE and SE). DE, LT and SE plan to develop new methods for monitoring benthic habitats and among the technologies listed are the drop cameras and remote sensing and methods for addressing the estimation of cumulative impacts and the effects of fishing gears on benthic habitats. FR plans to develop protocols and indicators for "boulder field" habitats and "bathyal domain habitats" on the Channel and Atlantic coasts. CY plans to focus on developing species DNA database for speedup the future monitoring on species composition and DK planned to improve the monitoring data availability and sharing.

7 Comparison with the 2014 monitoring programmes - Analysis of progress

This section intends to analyse the progress of the monitoring programmes in relation to the previous MSFD reporting. However, the way the information was provided in 2014 does not allow a meaningful assessment. Nevertheless, the comparison 2014-2020 has been performed to the maximum possible extent for those descriptors/MS for which an e-reporting is available also for 2014 and which contains at least some of the required information (Table 93).

Table 93. MS for which the 2014-2020 progress of the monitoring programmes has been analysed

Descriptor	MS	Total
D1-Pelagic Habitats	BE, DE, EE, ES, FI, FR, HR, LT, LV, NL, SE	11
D3	BE, DE, DK, EE, ES, FI, FR, HR, LT, LV, NL, SE	12
D4	BE, DK, EE, ES, FI, FR, HR, LT, LV, NL, SE	11
D6	BE, DE, DK, EE, ES, FI, FR, HR, LT, LV, NL, SE	12
D7	BE, DE, EE, ES, FI, FR, HR, LT, LV, SE	10
D8	DE, DK, EE, ES, FI, FR, HR, LT, NL, SE	10
D9	BE, DK, EE, ES, FI, FR, HR, LT, LV, NL, SE	11
D10	BE, DK, EE, ES, FI, FR, HR, LT, NL, SE	10
D11	BE, DK, ES, FI, FR, HR, NL	7

7.1 Addressment of gaps

The analysis of progress from 2014 monitoring has been done by comparing the dates to fill gaps for 'GES assessment', 'targets assessment' and 'activities and measures' as reported in 2014 with the dates on which adequate monitoring is or will be in place for 'coverage of GES criteria', 'coverage of targets' and 'coverage of measures', respectively, as reported in the current monitoring programmes. There are cases where a MS reported in 2014 that gaps were going to be, for instance, filled in 2020, but in 2020 they reported that adequate monitoring was already in place in 2014. In those cases, it has been considered that the gaps are currently addressed.

D3

FR did not address the gaps neither on GES assessment nor on targets assessment, although this seems to be a reporting issue rather than a monitoring shortcoming. 5 MS (DK, FR, HR, LT, LV) did not report on coverage of measures and 1 MS (DK) did not report on coverage of targets in their latest reports, so it was not possible to assess if they addressed relevant gaps.

Table 94. Addressment of the gaps identified by MS in 2014 in the current monitoring programmes – D3.

	BE	DE	DK	EE	ES	FI	FR	HR	LT	LV	NL	SE
Gap-filling date for GES assessment	Yes	Yes	Yes*	Yes	Yes	Yes	N	Yes	Yes	Yes	Yes	Yes
Gap-filling date for targets assessment	Yes	Yes	NA	Yes	Yes	Yes	N	Yes	Yes	Yes	Yes	Yes
Gap-filling date for activities and measures	Yes	Yes	NA	Yes	Yes	Yes	NA	NA	NA	NA	Yes	Yes

*Gaps addressed later than foreseen (2020 instead of 2014/2018). NA (unknown, no date reported for GES, target or measures coverage)

D7

In some cases, MS reported in 2014 that gaps were going to be, for instance, filled in 2020, but in 2020 they reported that adequate monitoring was already in place in 2014 or 2018 (e.g., DE and HR did so for the coverage of GES criteria and targets; LT for GES criteria, and EE for targets and measures) As said above, in those cases, gaps were considered currently addressed (Table 95). The gaps identified by MS in their 2014 monitoring programmes in relation to GES assessment, targets and measures can be therefore now adequately monitored by 90%, 80% and 60% of analysed MS, respectively.

Table 95. Addressment of the gaps identified by MS in 2014 in the current monitoring programmes – D7.

	BE	DE	EE	ES	FI	FR	HR	LT	LV	SE
Gap-filling date for GES assessment	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Gap-filling date for targets assessment	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes
Gap-filling date for activities and measures	Yes	Yes	Yes	Yes	Yes	NA	NA	NA	NA	Yes

NA (unknown, no date reported for GES, target or measures coverage)

D8

For D8, the gaps identified by MS in their 2014 monitoring programmes in relation to GES assessment, targets and measures can be now considered as adequately covered by 80%, 80% and 70% of analysed MS, respectively (Table 96).

Table 96. Addressment of the gaps identified by MS in 2014 in the current monitoring programmes - D8.

	DE	DK	EE	ES	FI	FR	HR	LT	NL	SE
Gap-filling date for GES assessment	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No
Gap-filling date for targets assessment	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Gap-filling date for activities and measures	Yes	Yes	Yes	Yes	Yes	NA	NA	NA	Yes	Yes

NA (unknown, no date reported for GES, target or measures coverage)

D9

For D9, the gaps identified by MS in their 2014 monitoring programmes in relation to GES assessment, targets and measures can be now considered as adequately covered by 91%, 91% and 64% of analysed MS, respectively (Table 97).

Table 97. Addressment of the gaps identified by MS in 2014 in the current monitoring programmes - D9.

	BE	DK	EE	ES	FI	FR	HR	LT	LV	NL	SE
Gap-filling date for GES assessment	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Gap-filling date for targets assessment	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Gap-filling date for activities and measures	Yes	Yes	Yes	NA	Yes	NA	NA	NA	Yes	Yes	Yes

NA (unknown, no date reported for GES, target or measures coverage)

D10

For D10, the analysis of the progress in relation to the gaps identified in their 2014 monitoring programmes is shown in Table 98.

Table 98. Addressment of the gaps identified by MS in 2014 in the current monitoring programmes - D10.

	BE	DK	EE	ES	FI	FR	HR	LT	NL	SE
Gap-filling date for GES assessment	No	Yes	Yes	Yes	Yes	No	Yes	No	No	No
Gap-filling date for targets assessment	No	Yes	Yes	Yes	Yes	No	Yes	No	No	No
Gap-filling date for activities and measures	Yes	Yes	Yes	Yes	Yes	NA	NA	NA	No	No

NA (unknown, no date reported for GES, target or measures coverage)

D11

For D11, progress from 2014 could be analysed for 7 MS (Table 99). In three cases, MS reported in 2014 that gaps were going to be, for instance, filled in 2020, but in 2020 they reported that adequate monitoring was already in place in 2014 (BE and FI did so for the coverage of GES and targets, FI did so for the coverage of GES, and ES did so for the three fields). In those cases, the gaps were considered to be addressed. The gaps

identified by MS in their 2014 monitoring programmes in relation to GES assessment, targets and measures are now adequately monitored by 71%, 71% and 57% of analysed MS, respectively.

Table 99. Addressment of the gaps identified by MS in 2014 in the current monitoring programmes - D11.

	BE	DK	ES	FI	FR	HR	NL
Gap-filling date for GES assessment	Yes	Yes	Yes	Yes	No	Yes	No
Gap-filling date for targets assessment	Yes	Yes	Yes	Yes	No	Yes	No
Gap-filling date for activities and measures	Yes	Yes	Yes	Yes	NA	NA	No

NA (unknown, no date reported for GES, target or measures coverage)

7.2 Fulfilment of 2014's commitments

This section compiles the plans to implement monitoring for GES assessment that MS reported in 2014 and analyses whether those plans have been addressed in 2020. However, as the reporting system in 2014 differs from that of 2020, the direct link between the two is not possible and, in many cases, the available information does not allow understand whether those plans have been now fulfilled. The analysis has been performed for selected descriptors and MS for which the required information is available in the e-reports.

D1-Pelagic Habitats

In 2014, BE, EE, FR, HR, LT, LV, SE, did not report for gaps and plans in the e-reports. DE reported for the same gaps and gap plans in 2014 and 2020.

EE didn't provide information specific on gaps related to pelagic habitat in 2014.

ES reported limitations in applying some indicators, thresholds values and reference levels at OSPAR level for monitoring pelagic habitats in 2014 and a partial coverture of the coastal areas whereas the shelf and oceanic environment would be better covered within the cycle. ES planned a better coverture of unique pelagic habitat such as canyons, seamounts during the following reporting cycle. In 2020, ES did not provide any information regarding the gaps and plans defined in 2014.

FI declared in 2014 that there were not needs for implementing monitoring action for D1C6 and in 2020 the MS declared no gaps in the monitoring programmes.

In 2014, NL reported the intention of contributing within OSPAR at improving indicators for pelagic habitats (Changes of plankton functional types (life form), and Plankton biomass and/or abundance) and investigate the possibility of establishing them as common indicators. Also, the opportunity of setting a monitoring based on the Continuous Plankton Recorder programme. These plans were consistent with the MS actions reported in 2020

D6

Information on gaps is not available in the 2014 e-reports for a number of MS (FR, SE, LV, and HR). BE declared in 2014 a not adequate monitoring programme and planned a monitoring in place by 2018, DK planned to start the monitoring by 2015 and DE planned to expand the monitoring to cover the 12 nm zone. FI in 2014 planned to start the monitoring based on the baseline mapping performed. LT declared the not adequate monitoring and planned to include hard bottom habitats for the next cycle. The 2020 reported information for these MS are coherent and highlighted an improvement of the monitoring programmes. NL in 2014 reported for indicators on extent of physical damages tested by 2014 which would be discussed and potentially applied at regional level by 2017. There is no reference of indicators for extent of physical damage in the next reporting cycle of this MS.

D7

The plans to implement monitoring for GES assessment reported in 2014 are compiled in Table 100. Overall, for more than half MS for which the progress from 2014 could be analysed, the information included either in 2014 plans to implement monitoring for GES assessment or in the current monitoring programmes reporting does not allow to understand if those plans have been now fulfilled. In 60% of the cases (BE, FI, FR, HR, LV, SE), the plans are not specified in the 2014 electronic reporting. In the remaining cases, the plans provided are quite generic. EE and LT only referred in 2014 to the lack of commonly agreed indicators at EU level for D7, and provided some relevant indicators in 2020. DE referred to the implementation of remote sensing methods, and

reported in 2020 that the currently existing methods are sufficient. Similarly, ES stated that the currently implemented monitoring strategies are adequate for the assessment of both D7C1 and D7C2. Thus, only in these two latter cases, it was possible to infer that the current monitoring addresses the plans of 2014.

Table 100. Fulfilment of 2014 commitments - D7.

	2014 reporting: Plans to implement monitoring for GES assessment	**2014 reporting: Gap-filling date for GES assessment**	**Fulfilment of 2014 commitments in current monitoring programmes**
BE	Not provided.	By 2014.	Not possible to check.
DE	In the course of the implementation of the MSFD, the expansion of the observation methods, in particular remote sensing (Sentinel 3, Copernicus services) is planned. Appropriate evaluation procedures are to be developed to match these new methods. The resources required for this have been registered for future budget planning.	By 2020.	The 2020 report states that "the currently existing monitoring is sufficient." Although "there may be local gaps in the stationary long-term measurements (…) these gaps do not endanger the success of general monitoring."; "Adequate monitoring was in place by 2014".
EE	Irreversible changes in hydrographic conditions due to human activities include changes in longitudinal sediment flow, freshwater inflow from the Curonian Lagoon, changes in stream structure resulting in changes to the physical and chemical properties listed in Table 1 of Annex III to Directive 2008/56/EC. Changes may be particularly relevant when they may affect marine ecosystems on a larger scale, and their assessment may indicate in advance the potential impact on ecosystems. Monitoring, including hydro-lithodynamic observations and modeling of shore changes. A recent (13-15 May 2013) workshop at the EU's DG for Research and Innovation noted that no realistic, quantifiable EU-wide indicators have yet been proposed for D7 (STAGES, 2013).	After 2020.	From the reported information it is not possible to evaluate. However, a number of relevant indicators are indicated in 2020 report related to D7C2.
ES	As already indicated in section 5f, the development of these indicators presents difficulties in terms of separating the different spatio-temporal scales, setting quantifiable objectives and determining thresholds. These issues have to be assessed in the following years, based on the data generated in the current monitoring program, and with the support of the Regional Agreements.	By 2020.	Relevant indicators for D7 are reported under the reporting field 'related indicators' in 2020. Moreover, the 2020 report states that "D7C1 it's adequately covered by the AH monitoring program" and "D7C2 would be covered through the joint analysis of the results of AH monitoring programme and HB monitoring strategy, whose objective is to calculate the area of each type of habitat affected by anthropogenic pressures, including the permanent alteration of hydrographic conditions".
FI	Not provided.	By 2014.	Not possible to check.
FR	Not provided.	By 2014.	Not possible to check.
HR	Not provided.	By 2018.	Not possible to check.
LT	Irreversible changes in hydrographic conditions due to human activities include changes in longitudinal sediment flow, freshwater inflow from the Curonian Lagoon, changes in stream structure resulting in changes to the physical and chemical properties listed in Table 1 of Annex III to Directive 2008/56/EC. Changes may be particularly relevant when they may affect	After 2020.	From the reported information it is not possible to evaluate. The only relevant indicators addressed in 2020 are BAL-LT-D05-5.2.2a - Average water transparency in summer, BAL-LT-D05-5.2.2b - Average annual water transparency, related to D7C1.

	2014 reporting: Plans to implement monitoring for GES assessment	2014 reporting: Gap-filling date for GES assessment	Fulfilment of 2014 commitments in current monitoring programmes
	marine ecosystems on a larger scale, and their assessment may indicate in advance the potential impact on ecosystems. Monitoring, including hydro-lithodynamic observations, and modeling of shore changes. A recent (13-15 May 2013) workshop at the EU's Directorate-General for Research and Innovation noted that no realistic, quantifiable EU-wide indicators have yet been proposed for D7 (STAGES, 2013).		
LV	Not provided.	After 2020.	Not possible to check.
SE	Not specified in the 2014 e-files (only reference is made to the 2014 text report: "See programme Hydrographic changes, chapter Conclusions).	By 2014.	Not possible to check.

D8

Overall, the current monitoring programmes reporting does not allow to understand if those plans have been now fulfilled. For instance, the plans are too generic (e.g., DE, EE, LT and NL) or are not specified in the 2014 electronic reporting (FR, HR and SE). ES provided more detailed plans, but the current reporting is not presented at demarcation level and moreover the indicators proposed in 2014 are not reported as elements or parameters in 2020. Only in the case of DK, it is possible to infer that the current monitoring addresses the plans of 2014, while FI indicated that no developments were needed (Table 101).

Table 101. Fulfillment of 2014 commitments - D8.

	2014 reporting: Plans to implement monitoring for GES assessment	2014 reporting: Gap-filling date for GES assessment	Fulfillment of 2014 commitments in current monitoring programmes
DE	Development of methods for the derivation of scientifically reliable threshold values for GES assessment, in cooperation and coordination with RSC and EU working groups.	By 2020.	From the reported information it is not possible to evaluate.
DK	Monitoring programme under establishment in the Danish parts of the North Sea and Skagerrak in 2015 and onwards. However, monitoring is ongoing in the Kattegat area which is a part of the subregion North Sea.	By 2014 or 2018, depending on the programme.	The programme 'Contaminant levels - in sediment' has been modified from 2014 and includes ten stations outside 12 nautical miles in the North Sea and five stations distributed on the Skagerrak (1), Kattegat (2), Ar-konabassinet (1) and east of Bornholm (1).
EE	Criteria for GES in bottom sediments, as well as for the assessment of the effects of pollutants, will be proposed at regional level in the CORESET II working group. It is planned to take into account the results of the work of this group.	By 2018.	From the reported information it is not possible to evaluate.
ES	Some indicators have been proposed to be developed through pilot studies: In the North and South Atlantic demarcations, studies of lysosomal membrane stability and micronucleus frequency will need a period of development. In the case of the measurement of metabolites in fish bile, a pilot study is necessary to search for the most suitable species prior to its implementation. The Canarian demarcation, due to its special geographical and biological characteristics, requires a pilot study prior to the implementation	By 2014.	From the reported information it is not possible to evaluate. The indicators proposed for development are reported under the reporting field 'related indicators', but not as monitored elements or parameters. Moreover, ES reports for D8 all subregions together, so it is not possible to differentiate the demarcation.

	2014 reporting: Plans to implement monitoring for GES assessment	2014 reporting: Gap-filling date for GES assessment	Fulfillment of 2014 commitments in current monitoring programmes
	of all the chemical indicators and biological effects. These pilot studies will be oriented towards the selection, if possible, of sedimentation areas for taking sediment samples and the selection of a bioindicator species that can make up for the absence of mussels in the area. In the two Mediterranean marine demarcations, a pilot study would be necessary for the study and selection of suitable species for both imposex, intersex and PAHs metabolites in fish bile.		
FI	No immediate development needs.	By 2014.	Not needed.
FR	Not provided.	By 2014.	Not possible to check.
HR	Not provided.	By 2018.	Not possible to check.
LT	Criteria for GES in bottom sediments, as well as for the assessment of the effects of pollutants, will be proposed at regional level in the CORESET II working group. It is planned to take into account the results of the work of this group.	By 2018.	From the reported information it is not possible to evaluate.
NL	In 2013, OSPAR has established common indicators for the input of the metals mercury, cadmium and lead via air and water, the concentrations of mercury, cadmium and lead, PCB's, PAHs and PBDE in biota and sediment, organotin in sediment and the incidence of imposex/intersex in sea snails. These indicators are based on the established OSPAR monitoring and assessment programmes CAMP, RID and CEMP and will contribute to the OSPAR Intermediate Assessment in 2017. The Netherlands uses the measurements in sediment only for determining trends, not for assessing environmental quality. As stated above, monitoring and assessment are already coordinated within the frameworks of the WFD and OSPAR. In the coming years, the Monitoring Plan is adjusted as necessary on the basis of the results of coordinating the various measurement methods under the WFD and OSPAR in terms of indicators (23) Concentrations of contaminants in water and (24) in biota.	By 2014.	From the reported information it is not possible to evaluate.
SE	Not specified in the 2014 e-files (only reference is made to the 2014 text report)	By 2020.	Not possible to check.

D9

The current monitoring programmes reporting does not allow to understand if the plans reported in 2014 have been now fulfilled. Only in the case of ES, the gaps indicated in the previous reporting remain also in 2020 (Table 102).

Table 102. Fulfillment of 2014 commitments - D9.

	2014 reporting: Plans to implement monitoring for GES assessment	2014 reporting: Gap-filling date for GES assessment	Fulfillment of 2014 commitments in current monitoring programmes
BE	Not applicable.	By 2014.	There were no commitments in 2014.
DK	Not provided.	By 2014.	Not possible to check.
EE	There is a lack of knowledge about the relationship between contaminants in seafood for human consumption, the effects of the accumulation of contaminants in marine organisms, and the precise threshold values that define safe levels of contaminants in food. There is still a lack of effective methods to identify the cause of	By 2020.	From the reported information it is not possible to evaluate (e.g. whether the sampling has increased or whether there are now regional recommendations to follow).

	2014 reporting: Plans to implement monitoring for GES assessment	2014 reporting: Gap-filling date for GES assessment	Fulfillment of 2014 commitments in current monitoring programmes
	increased levels of contaminants in foods that exceed the levels of contaminants. The issue of increasing the sample will be considered and recommendations at regional level will be taken into account.		
ES	The use of information from food control programs is useful but has limitations. The data must have sufficient reliability regarding its exact geographical origin, since the absence of traceability prevents the indicators from being attributed to a specific marine demarcation. It is essential to define the most representative marine species and the adequate minimum frequency to detect the variations of the indicator and consequently have an approximate idea of the environmental state of the marine waters of the demarcation. To this end, work will be done with the health authorities of the Autonomous Communities, which are responsible for carrying out this monitoring, in order to increase the comparability of information and access to it.	By 2014.	No, in 2020 the traceability of the samples is a weak point that still should be improved. Additionally, D9 assessments have still to be interpreted with caution since the direct relationship between the contaminants in fishery products evaluated through D9 and contamination in the marine environment is not entirely clear.
FI	No immediate development needs.	By 2014.	Not needed.
FR	Not provided.	By 2014.	Not possible to check.
HR	Not provided.	By 2018.	Not possible to check.
LT	There is a lack of knowledge about the relationship between contaminants in seafood for human consumption, the effects of the accumulation of contaminants in marine organisms, and the precise threshold values that define safe levels of contaminants in food. There is still a lack of effective methods to identify the cause of increased levels of contaminants in foods that exceed the levels of contaminants. The issue of increasing the sample will be considered and recommendations at regional level will be taken into account.	By 2020.	From the reported information it is not possible to evaluate (e.g. whether the sampling has increased or whether there are now regional recommendations to follow).
LV	Not specified in the 2014 e-files (only reference is made to the 2014 text report).	By 2018.	Not possible to check.
NL	For the assessment of contaminants in the marine environment monitoring in biota is used (See sub-programme ANSNL-D08-Sub2-OSPAR-ConcBiota). It is being investigated whether there could be an advantage in combining these monitoring programmes. Coordinated monitoring and assessment are already taking place under the applicable European laws and regulations.	By 2014.	As 2020 monitoring has not been changed from 2014, it seems that the combination of monitoring programmes (D8 and D9) has not been carried out. However, this cannot be considered a gap.
SE	Not specified in the 2014 e-files (only reference is made to the 2014 text report).	By 2020.	Not possible to check.

D10

The analysis of the progress of plans to implement monitoring programmes for GES evaluation reported in 2014 by MS is compiled in Table 103. 3 MS (BE, FR, HR) out of 10 MS did not specify plans in the 2014 electronic reporting and SE referred to the 2014 text reports. DK, ES, FI, LT and NL provided information from which it is possible to infer whether MS have fulfilled their 2014 commitments.

Table 103. Fulfillment of 2014 commitments – D10.

	2014 reporting: Plans to implement monitoring for GES assessment	2014 reporting: Gap-filling date for GES assessment	Fulfillment of 2014 commitments in current monitoring programmes
BE	Not provided.	By 2014.	There were no commitments in 2014.

	2014 reporting: Plans to implement monitoring for GES assessment	2014 reporting: Gap-filling date for GES assessment	Fulfillment of 2014 commitments in current monitoring programmes
DK	An extended programme is under development. The programme will use existing data and monitoring activities and add relevant elements. The programme will be in place from 2015.	By 2018.	According to the new report, adequate monitoring is in place by July 2020. However, further gaps in the monitoring in the water column and seabed were identified.
EE	From the reported information it is not possible to evaluate.	After 2020.	Not possible to check.
ES	There is still no consensus at European / regional level on the thresholds that would define BEA in this descriptor. In addition, work is considered necessary to assess the input of marine litter via watercourses and effluents, which is insufficiently addressed in the present monitoring programme.	By 2014.	The reported information describes the launch of new programmes to assess the composition, amount and distribution of litter and microlitter in the coastline, the surface layer of the water column and the seabed. The monitoring of strandings of marine animals, together with the new litter in biota programme, would estimate the litter ingested by marine animals and the adverse effects.
FI	It is expected that GES can be assessed by 2018.	By 2014.	From the information provided it is not possible to check. According to the new report, adequate monitoring is in place by July 2020, and no gaps are also reported.
FR	Not provided.	By 2014.	Not possible to check.
HR	Not provided.	By 2018.	Not possible to check.
LT	Monitoring of marine litter along the Lithuanian coast is planned to start in 2016. Methodologies for the detection of microparticles are being tested in the region and will be applied nationally. Methodologies for collecting data on litter on the seabed are being harmonised at regional level. Currently, there are also no data on the impact of marine litter on marine fauna and no suitable bioindicator has been identified/validated to monitor the impact of marine litter on marine fauna. There is a lack of appropriate methods for studying marine litter ingested by marine animals in the Baltic Sea region. A region-wide action plan on marine litter has been developed and is to be implemented at national level.	After 2020.	No. According to the reported information, monitoring plans have been updated and the spatial and temporal needs to determine GES have been defined; however, the programmes adequate monitoring will be in place by 2024.
NL	The internationally coordinated indicators (31) litter on beaches and (32) plastic in stomachs of northern fulmars are already being used in the North Sea region in the context of OSPAR. In 2013, the OSPAR commission designated litter on the seabed as a prioritised candidate indicator. This indicator can be established as a common indicator in one to two years. The indicator IBTS (International Bottom Trawl Survey) is being developed for this. In anticipation of this, Rijkswaterstaat is already carrying out this study in combination with ICES fish monitoring. If necessary and depending on when this process will yield results, the MSFD Monitoring Plan will be adjusted in 2015 or 2016. In cooperation with the International River commissions the sources of litter are being looked into, in particular from litter that enters	By 2014.	According to the information provided, the IBTS survey provides an initial impression on the quantity of litter on the seabed, but the efficiency is low for marine litter and therefore inadequate for quantitative analysis. In terms of microlitter, there is no monitoring in place yet.

	2014 reporting: Plans to implement monitoring for GES assessment	2014 reporting: Gap-filling date for GES assessment	Fulfillment of 2014 commitments in current monitoring programmes
	the marine environment through the rivers. Experimental and field research contributes to the development of an indicator for microplastics in OSPAR, including a risk assessment for organisms. Risks of nanoplastics are also being mapped. The indicators mentioned above, such as litter on beaches and on the seabed and plastic particles in stomach of fulmars, and the results of the research will contribute to the OSPAR Intermediate Assessment in 2017 and the OSPAR QSR 2021.		
SE	Not specified in the 2014 e-files (only reference is made to the 2014 text report).	By 2020.	Not possible to check.

D11

The plans to implement monitoring for GES assessment reported in 2014 are compiled in Table 104. Overall, the current monitoring programmes reporting does not allow to completely understand if those plans have been now fulfilled. In some cases, the plans were not specified in the 2014 electronic reporting (BE, FR, HR) or they were too generic (ES) to allow for a progress assessment. DK and FI mentioned the use of results and experiences acquired within the BIAS project and in the HELCOM region to fulfil their commitments, and NL identified the importance of a regional cooperation within the OSPAR region, as the main cause behind the delay in achieving and adequate D11 monitoring. In the case of ES and NL, it is possible to infer that the current monitoring addresses the plans foreseen in 2014, while DK and FI indicated that no developments were needed.

Table 104. Fulfilment of 2014 commitments – D11.

	2014 reporting: Plans to implement monitoring for GES assessment	2014 reporting: Gap-filling date for GES assessment	Fulfilment of 2014 commitments in current monitoring programmes
BE	Not provided.	By 2018.	Adequate monitoring was in place by 2018; no further gaps are reported.
DK	Results and experiences from BIAS and BIAS+ will be used to decide how monitoring should be set up towards 2018.	By 2018.	From the information provided it is not possible to assess if this procedure was applied, however, according to the new report adequate monitoring is in place by July 2020 and no further gaps are identified.
ES	This program will allow obtaining the reference level of the two indicators, which in both cases will be based on the current situation. The results of both monitoring will not be conclusive in relation to whether the GES is fulfilled, but it is considered that they will collect essential information to improve knowledge in relation to noise sources. It will also be useful for evaluating the impacts of noise on the populations of species that are more sensitive to this pressure and, as a consequence, for specifically defining the threshold between good environmental status and worse than good status.	By 2020.	The reported information describes the launch of the RS1 monitoring program to record impulsive noise-generating activities and thus assess the level and trends of Low and medium frequency impulsive noise in the Spanish marine demarcations. On the other hand, the RS2 monitoring program would estimate the impact of noise on species. Despite the lack of historical data that allow establishing annual trends and the evolution of the indicator itself, progress is being made in understanding underwater noise, and in the development of the indicators.
FI	It is expected that GES can be assessed by 2018. Underwater noise indicators will be developed by BIAS project and HELCOM on the basis of current	By 2018.	Not needed. According to the reported information, the program consists of one sub-program to monitor the continuous

	measurements and they will be fully operational by 2018.		underwater sound pressure level and the occurrence of man-made underwater impulsive noise. Adequate monitoring is in place by 2018 and no further gaps are identified.
FR	Not provided.	By 2014.	Not possible to check.
HR	Not provided.	By 2018.	Not possible to check.
NL	NL has chosen to work towards the set-up of a monitoring programme in regional cooperation, rather than on a national level. The resulting delay is preferred above a non-regional approach. The elaboration of the indicators referred to, the research measurements and the assessment will be coordinated in an international context. Together with UK, NL is leading the TS Noise under the EU Common Implementation Strategy. This working group has developed guidance for translating these indicators into actual monitoring. For the OSPAR region, this is being taken up by the ICG Underwater Noise, for which NL also acts as co-leader. In 2014 OSPAR has established the indicator on loud low or mid frequency impulsive sound as a common indicator, which will be operational within 1 or 2 years for all OSPAR regions, including the N Sea. It is expected that in 2015 a common indicator on continuous low-frequency sound will be established. Both indicators are expected to contribute to the OSPAR Intermediate Assessment in 2017.	By 2018.	According to the information provided, in the last ten years, a knowledge has been developed in the region in relation to the design of a monitoring and assessment system for underwater noise. Monitoring is in place for D11C1 and is sufficient to assess GES. For D11C2, an operational monitoring programme is expected to be in place in 2021. However, although a lot of progress has been made, there are still gaps and for the time being, the effects of underwater noise are assessed through data collected from D1 monitoring. A joint data collection within the OSPAR region is being carried on.

8 Conclusions and recommendations

8.1 Art. 11 Timing/ Reporting

Overall for all descriptors, about two-thirds of the monitoring programmes reported are modifications, updates and new programmes (although the proportion of new programmes is rather low), suggesting MS adjustments for MSFD implementation. The remaining one third of the monitoring programmes remained the same as in 2014 reporting cycle.

MS could benefit from avoiding peak reporting periods and lightening the unnecessary reporting of unchanged programmes, hence delays in the submission of the reports might be reduced. As a potential way forward, which could be considered for the ongoing MSFD review process, a continuous reporting system could be implemented, which would allow the introduction of updates and new programmes as needed instead of starting a complete reporting for every cycle. In that case, it would be helpful to have a new field in the reporting template with a drop-down menu, where MS can select and describe which item(s) of the programme have been modified (e.g., elements, frequency, parameter etc.). This new field would facilitate the assessment of consistency and adequacy of the monitoring programmes. In addition, there is still room to exploit links between monitoring programmes established for other policies and similar ones established for MSFD. The outcome of established monitoring programmes could directly update the continuous reporting for the MSFD.

8.2 Reporting issues

This analysis has revealed a number of reporting issues that somehow hamper the analysis of the information. Main issues and some recommendations are provided here for consideration for further improvement of the reporting system (through the Working Group on Data, Information and Knowledge Exchange, WG DIKE) and to increase the MS' common understanding for the ambiguous/misreported fields.

Overall issues

- The analysis of monitoring information would benefit from trained personnel of National Competent Authorities on the compilation of the reporting format.
- The initial XML files from the MS's reports are organized in a multidimensional database, which is then simplified to the xls files that were provided by WISE Marine for the analysis. The transformation of the SQL database to xls aggregates the data in a random way, which may cause loss of data or inconsistency in the reported information per row. Current format does not allow examining monitoring at MS level; the metadata are often aggregated in the same excel cell (e.g., purpose, targets, measures).
- MS have the right to complete their reports in any official EU language and so the 'MonitoringStrategyDescription' is often written in national languages. However, this adds difficulty to the review as it can lead to misinterpretation of the information reported. Moreover, the descriptions vary greatly among MS in length and detail. Some MS did not report any detail on their monitoring plan or purpose, while, on the other hand, several MS reported very long descriptive texts for some of those fields, which were often cut by the online system (due to the space limitations of the reporting), and thus were not useful for a proper interpretation of the content. Harmonization is needed on the content and points to cover within the text of the monitoring strategy descriptions. More detailed reporting guidance would be advised for this.
- The variety of elements/parameters is so wide that a proper comparison or assessment of monitoring methods is not always feasible. Moreover, some MS include a number of features, elements or parameters that are not strictly related with the descriptor under review, i.e., which are either referred to other descriptors or classified under a null or 'not relevant' category under the field 'GEScriteria'. In those cases, these reporting entries have normally had to be excluded from the analyses, unless a further look at other reporting fields enabled the assignation to the particular descriptor and its use for some descriptive interpretation of the information. A consistent reporting of the relevant features, elements, and parameters for the descriptor across MS would be beneficial for the analytical process.
- The reporting of multiple options, often separated by a comma with no space, in the same cell of some reporting fields (e.g., monitoring types, spatial scope, monitoring purpose etc.) complicates the analysis and may lead to its misinterpretation. Further guidance to consistent and precise reporting of the relevant information for the descriptor would substantially facilitate the analytical process.

- Some reporting fields seem not to be relevant. For instance, 'MonitoringPurposes' is not particularly informative, as evidenced by the wide range of MS responses. This field has the same pattern for each region and criterion, indicating that the MS report the same information for all criteria, but without been consistent with each other. This field could be omitted or clarified to provide more substantial information.
- The information on the spatial scope and monitoring frequency does not provide details on the spatial and temporal variability across sampling stations, hence it is no possible to assess the variability of the sampling strategy. Moreover, monitoring frequency is often reported as 'as needed' (this is an option from the drop-down menu). Although additional information can be sometimes found in other fields, such as 'MonitoringDescriptionStrategy' and 'MonitoringDetails', this reporting entry as such is not informative.
- The reported information on the adequacy of monitoring programmes to cover data and assessment needs for other reporting obligations and articles under the MSFD (namely articles 8, 9, 10 and 13) is exclusively based on the MS interpretation. Although this analysis can provide a picture of where MS believe we stand in terms of coverage and gaps in their monitoring programmes, these entries are inconsistently reported and do not provide meaningful information. This can be largely due also to the fact that there are still many gaps in the understanding of common targets, in the common GES determination and in the harmonisation of measures.
- The use of drop-down menus that allow to select one single option for elements/parameters for those descriptor/criteria where this is currently missing would ease both the reporting harmonization and the analysis (e.g., agreed lists of commercial species specific for each sub-region under D3 elements, biological-effect methods under D8C2 parameters, group of animals listed in the GES Decision under D10C3). An additional and accessory field to provide specific related information could be also introduced.
- Similarly, there is overall poor harmonization in the reported coherence with other policies. A drop-down menu with a restricted number of options (i.e., including programs only relevant to the particular descriptor) under 'OtherPoliciesConventions' would be helpful.
- Splitting 'Gaps' and 'Plans' in separate fields could be an option to improve the clarity of the information provided.
- MS should avoid reporting for combined (sub)regions (e.g., ES, DK, SE).
- MS should ensure they report under the correct category (e.g., for features) and provide the required information (e.g., individual species under 'Elements" for D3). Moreover, MS should limit/avoid the reporting of 'not relevant', 'not applicable', 'unknown' or blank for key fields such as elements or parameters. MS should also avoid either potential under-reporting or over-reporting of elements.

Descriptor-specific issues

- Where relevant, monitoring programmes for D2C2 and D2C3 should be linked to those for Descriptors 1, 4, 5 and 6.
- For D3, the options available under 'SpatialScopes' are not particularly informative. For this Descriptor, it would be more important to report on the extent that the distribution of each stock is covered by the monitoring programmes of all relevant MS.
- For D4, MS should report also individual species (as sub-elements) used to determine the 'Elements' (TGs).
- The species list for D1 (mammals, reptiles, seabirds, fish and cephalopods) is essential for the reporting as it allows a harmonised and typo/synonym error free reporting. In particular, for marine turtles, while all species in the European waters are included in the monitoring programmes of the MS, missing MS like EL, PT, and MT, hinders an overview of the turtles' monitoring under the MSFD.

8.3 Consistency, adequacy and coherence

8.3.1 Coverage of features, elements, and parameters

The main elements, features and parameters monitored across EU for the different MSFD descriptors are compiled in Annex I (Table A1 to Table A26). This general overview provides crucial information for identifying gaps in the established monitoring programmes as well as a very helpful basis to support further discussions to increase harmonisation and improve synergies across regions, especially for highly mobile species such as seabirds and for transboundary issues such as chemical pollution and marine litter.

Although the situation in terms of coverage is different for each particular descriptor (and criteria), this analysis has overall highlighted that there are still significant differences among MS. Most relevant findings are summarized here:

- All marine mammals reported under MSFD Art. 8, 9 and 10, are also reported in the monitoring programmes (both in 2014 and 2018). Regarding the parameters, it was expected that D1C3 has more compared to the other criteria, as it is open to more indicators that can provide information for the population characteristics. Especially for marine mammals the information generated by D1C3 is very relevant to the species biology and status, however, they are not easily measured for the highly mobile species with population distribution far beyond the extent of the joint monitoring programmes or MS' jurisdiction. There are cases with mature and advanced monitoring programmes e.g., for seals, covering many parameters (e.g., *Halichoerus grypus* reported by 10 MS and more than fourteen parameters), and cases with less advanced monitoring programmes usually because of the spatial distribution of the species (e.g., *Mesoplodon europaeus*, reported by 1 MS for four parameters).
- For marine reptiles, it was also expected that D1C3 has many more options than other D1 criteria, as it is open to more indicators that can provide more information for the population characteristics. In particular for marine turtles the information generated by D1C3 is more relevant to the species life cycle, compared to other primary criteria like D1C1 and D1C4. However, to harmonise the monitoring for the D1C3 parameters, the experts need to map the available information (e.g., OSPAR indicators, IMAP indicators and HD assessments) and explore how these parameters and associated data can be generated jointly or according to common agreed protocols.
- The analysis of the monitored seabird species revealed that the number of species greatly vary across MS, regions and species groups. This indicates that the MS still report and monitor what is available, as they also did in the first MSFD reporting cycle in 2014. It seems that there is no a common approach even within the same region on what should be assessed in terms of species and how many should be included in each species group. Moreover, also it was expected that D1C3 has many more parameters as it is open to more indicators that can provide information for the population characteristics compared to the other criteria. For seabirds, the information generated by D1C3 is more relevant to the species biology and status, compared to the distribution of the species. However, to harmonise the monitoring for the D1C3 parameters, the experts need to map the available information (e.g., OSPAR indicators) and explore how these parameters and associated data can be generated in other regions and possible species, if needed.
- There is an issue in the reporting related to the parameters for fish and cephalopods. According to the GES Decision, there should be specific parameters reported per criterion. Given the lack of an agreed scheme per species group, which would provide specific guidance on a set of agreed parameters, integration rules and common methods to set thresholds, the parameters should be automatically linked to D1 criteria to limit misreporting and inconsistency in their reporting. The analysis of the monitored species revealed that the number of species varies across MS, regions and criteria. This indicates that MS still report and monitor what is available, as they also did in 2014, which mostly derives from the CFP or regional indicators. There is no common approach even within the same region on what should be assessed in terms of species and how many should be included in each species group (e.g., in the Baltic, EE reported 44 species, while PL, LT and LV less than six). Moreover, MS do not have a harmonised approach regarding the reporting of commercially exploited fish that are relevant to D3. Although this is a reporting issue, it remains under the implementation of the Directive to harmonise and agree on this set of species at regional level and provide guidance for their reporting and assessment. In principle, the commercially exploited species should only be assessed under D3 and the three D3 criteria should be treated in analogy with the three D1 primary criteria for fish (D1C1, D1C2 and D1C3).
- The information derived from D1C3 is also crucial for some species for the population viability, such as growth rate, sex ratio and size/age distribution. Again, to harmonise D1C3 parameters monitoring, experts need to map the available information (e.g., HELCOM fish indicators) and explore and evaluate how these parameters and associated data can be generated in other regions and possible other species.
- For D1, MS, through the regional cooperation and the MSFD Biodiversity expert network, should map the common species (or missing species) within each species group. Once this information is available at regional level, then the monitoring gaps could be covered and the regional harmonisation achieved.
- D1C6 is well covered across MS and regions regarding the required elements and compared to other biodiversity themes. However, the MSFD expert network on pelagic habitats has only recently started to harmonise elements, assessments and monitoring and the outcome of this work is not yet reflected in the

MS monitoring reports. In-situ sampling is the main monitoring approach used by MS. Differences across MS exist on the monitored elements (i.e., Zooplankton communities or Phytoplankton communities) and parameters. Differences on elements and parameters also can be due to the taxonomic approach used for sample collection and analysis. Monitoring at fixed stations do not provide comparable data to other sampling approaches such as the Continuous Plankton Recorder (CPR), which is widely used in the OSPAR region. Common indicators and agreed methods to overcome the limitations on taxonomy identification uncertainties and the reduction of the MS effort, are under discussion within the Pelagic Habitat experts of the MSFD Biodiversity network.

- For D2, 88% of MS have monitoring in place for the features 'Newly introduced non-indigenous species' (D2C1) and 'Established non-indigenous species' (D2C2), and indicated collecting main (e.g., presence, abundance) and related-to-criterion parameters. For D2C3, only 2 MS (LT and RO) reported monitoring on the feature 'Adverse effects on marine species and habitats'.
- MS with no monitoring reported for D3C3 (LV, FR, ES, IE, and NL) should fill this gap.
- Monitoring methods for D4 are largely based/referred to methods used for D1 criteria. Several inconsistencies are the reporting issues that need to be streamlined.
- For D5, all the parameters have been correctly reported with the associated criteria.
- Generally, the elements and criteria for D6 are well covered by the MS, although there are some inconsistencies in the way the parameters reported (e.g., some default parameters were reported as 'Parameter_other').
- The assessment D7 is done through the monitoring of the physio-chemical characteristics of the water body, such as temperature, ice cover, salinity, etc., as well as through the monitoring of physical interventions, influences on hydrological processes or changes in habitats that may result in any lasting change in the hydrographical conditions or lead to a risk to species and habitats. Given the heterogeneity of factors determining possible changes in hydrographic conditions, monitoring programmes described by MS are highly variable and aim to collect data both on the environmental state and impacts, and on the related pressures and human activities causing the pressures. The features and elements that may be relevant for assessing hydrographic characteristics or benthonic habitats are not homogeneously reported, with only a few of them indicated by the majority of MS, and a large number of other features, elements and parameters reported by a very limited number of MS. The monitoring methods described are only partially based on common EU or regionally agreed methods, and include the use of CTD and other sensors, observers from ships, land or aircraft, drones, trawling, numerical models, administrative information, and, above all, the information obtained from remote surveillance such as satellite monitoring and the Copernicus marine service.
- For D8C1, a relatively good coverage of contaminants (elements) is seen for some Priority Substances of the WFD (e.g., metals, PAHSs, PBDEs, and dioxins). For the matrices (parameters) and additional contaminants, there is high variability among MS. As thresholds or quantitative assessment criteria are not yet available for a high number of combinations elements/parameters (especially in biota and sediments), the determination of GES is challenging. The variability is also high in relation to the biological-effect methods (parameters) used for monitoring D8C2.
- Overall, the coverage of contaminants (elements) under D9 can be considered as good, in particular for those regulated under Food Regulation 1881/2006.
- For D10, the elements defined under the GES Decision are overall well covered in relation to D10C1. In relation to D10C2, good coverage is mainly found for the compartment 'surface layer of the water column'.
- The assessment of D11 is done by measuring the levels of noise by means of sensors such as hydrophones and by identifying and listing in dedicated registers the main activities producing marine noise. Monitoring programmes described by MS are quite variable and aim both at the assessment of state and impacts and the assessment of pressures and human activities related with underwater noise. The monitoring methods described are mostly based on the Monitoring guidance for underwater noise in European seas produced within the MSFS by the TG Noise, and several MS only made reference to the guidance or regionally agreed methods. However, some MS also provided further specific details on the techniques used for monitoring underwater noise, such as moored stations, battery powered hydrophones, or the collection of AIS data to model underwater noise based on marine traffic. Overall, monitoring covers adequately the relevant features and parameters, with a slight variability on the coverage of D11C2 elements, related to the

frequency bands assessed by MS.

8.3.2 Coverage of criteria

The criteria coverage is not homogenous among MS (as shown in Figure 26). In general, MSFD primary criteria are relatively well covered. In particular, criteria D1C2, D3C1, D3C2, D5C1, D8C1, D9C1, D10C1 and D11C1 are included in the monitoring programmes of all MS reporting on the corresponding descriptor. The less covered primary criteria (monitored by 10 or less MS) are D1C1, D1C5, D4C1 and D4C2. Regarding secondary criteria, some of them are poorly covered (namely D2C3, D4C4, D5C6, D5C8, D8C4, and D10C4), while others are monitored by a significant number of MS (at least 10): D2C2, D5C4, D7C1, D8C2, and D10C3. Nevertheless, the fact that the criteria are reported in the monitoring programs does not directly imply that the consideration of the corresponding elements or parameters is sufficient or harmonized (as explained above). Moreover, 'not relevant' is often reported under the field 'GEScriteria'. In many of these cases, it is very difficult to assign the corresponding information to a specific criterion or even understand whether it relates to the descriptor under review. Therefore, the analysis of the criteria coverage can be somehow underrepresented.

Relevant remarks include:

- For D1-Marine mammals, it seems clear that the coverage of GES criteria is based on the availability of data and methods that come from other policy obligations (HD and RSCs). D1C2, D1C4 and D1C5, with established monitoring programmes (HD), are well covered in terms of species. D1C1 is also well covered for those marine mammals that are affected by fisheries and data are collected by CFP. Although it would expected that MS use more primary than secondary criteria, very few (7 MS) have reported monitoring programmes for D1C1, which should be considered in the monitoring gaps. While all MS have reported monitoring programmes for D1C2, only 7 MS have done so for the habitat criterion (D1C5), which would be expected to derive from the HD for all marine mammals.
- For D1-Marine reptiles, the established monitoring programmes do not equally cover the needs for the GES criteria. D1C2 and D1C4 have more established monitoring programmes (coming from HD) compared to D1C1 and D1C5. For D1C1, there is lack of data despite the obligation of the MS to count and report turtles' bycatches per metier pursuant to CFP. D1C5 should also derive from the HD assessments, especially for turtles that are closely dependent to particular habitats for spawning and feeding. However, this review shows that there is either a monitoring gap for these criteria or no access to existing data. D1C3, which is a secondary but meaningful criterion, was reported by 4 MS, indicating that there is already some monitoring in place to support the assessment of this criterion. The importance of D1C3 is in line with the recommendations for assessment and integration rules for turtles.
- For D1-Fish and cephalopods, it is also clear that established monitoring programmes are based on the availability of data and methods (mostly coming from the CFP) and do not equally cover the needs for the GES criteria in terms of species. Although it would expected a better coverage of primary than secondary criteria, very few MS have reported monitoring for D1C1 and D1C5 (e.g., for fish, only 6 MS and 34 species out of the 320). Experts would need to identify which fish are subjected to bycatches and then propose monitoring programmes or use existing ones (e.g., CFP) to generate and report these data under the MSFD, analogously to D3C1 for commercially exploited species. Missing criteria should be considered in the updates of the monitoring programmes in a species-by-species case, since it is not evident from the reporting whether the species with established monitoring programmes (from HD) have data and assessments for covered criteria (e.g., D1C5). Particularly, for the few fish (anadromous), which are covered by the HD, all D1 criteria are considered as primary and as such the assessment of their habitats should derive from the HD reporting and monitoring. For cephalopods, only four MS have provided monitoring programmes, indicating the need for better coordination and collaboration across MS for those species. The incomplete reporting can be partially explained by the inconsistent way in which MS have reported cephalopods' monitoring under D1 and D3. There are huge gaps in D1C1 and D1C5 monitoring, whereas only D1C2 has established monitoring programmes for at least one species. Experts should extract a set of potential by-catch species from the list of species of MSFD concern and then propose proper monitoring methods, including joint monitoring to cover this gap. Same for D1C5, where several species can be linked with particular habitats, which, if affected, can cause reduction in species population. This causal links should be tested at species level and identify those species where D1C5 needs to be assessed.
- For D1-Birds, the established monitoring programmes also do not equally cover the needs for the GES criteria in terms of species. For D1C2 and D1C4 (with established programmes coming from HD and BD), the number of assigned number of species is higher than for D1C1, again indicating the need to identify

the seabirds subjected to bycatches and then propose monitoring programmes or use the available ones for MSFD purposes.

- Overall, monitoring covers adequately the relevant criteria for D3 (except D3C3), D8, D9, D10 (primary criteria) and D11. The coverage of some secondary criteria is very limited (e.g., D2C3, D7C2, and those of D5 and D10). This probably reflects the lack of agreed methods at regional or EU level for the assessment of those criteria. For instance, for D10, the MSFD TG ML, in close collaboration with MS and RSC delegates, is undertaking efforts to provide updated guidance on monitoring of marine litter in line with the scope of the MSFD and continue supporting further monitoring programmes.
- Regarding D6, although not all MS have reported all criteria, there is overall a good harmonization and coverage at regional level, with the exception of the Black Sea. It is expected that the ongoing work of the TG Seabed will contribute to the further harmonisation of the monitoring and assessment, including regional cooperation.

8.3.3 Spatial/temporal scope and monitoring frequency

As said above, the reported information on the spatial scope cannot be easily analysed since MS combine several areas of coverage (e.g., for contaminants, for each species etc.) in the same reporting cell. Moreover, the default spatial delineation is not self-explanatory and does not provide details on the variability across sampling stations. The spatial coverage should indicate the extent of the area covered by the monitoring programme (as a percentage or layer), for instance, either within the area of jurisdiction or within the area of species spatial distribution (e.g., BHTs). As this information is not provided, it is not very helpful. For instance, for the highly mobile species, this field should either correspond to the monitoring extent against the spatial distribution or should be omitted to avoid unnecessary burden.

In any case, from the reporting it is possible to infer that monitoring mainly refers to coastal waters, suggesting the need for improved monitoring efforts in other (often) underrepresented areas (namely beyond MS marine waters).

The implementation of the monitoring with satellite observations as well as the development of new technologies and sampling devices could be a way for improving the monitoring extent. Ecological modelling is also a promising tool for standardising the monitoring effort.

Regarding the temporal scope, it provides an overview of the duration or starting point of the established monitoring programmes and indirectly the number of the new monitoring programmes. In addition, it provides the number and duration of programmes per criterion, which can facilitate the identification of monitoring gaps. However, this field should not be evaluated for the temporal consistency of the monitoring programmes since each MS has different established monitoring programme (e.g., for different species group or contaminants) and different related policy obligations (e.g., WFD or CFP) that not always are synchronised. For instance, it would be expected to have more monitoring programmes in place for marine turtles due to the HD Directive than recently established ones. The later would suggest that some MS have started monitoring specifically for the MSFD instead of due to previous policy obligations. Additionally, as MS seem to mix the temporal window of the GES assessment with the total length of the available time-series, it could be worth having two separate reporting fields, e.g., 'time-series available' and 'temporal window for the GES assessment'.

Regarding the monitoring frequency, the information provided is too broad (refers to the whole monitoring programme) and, given the high number of monitoring programmes combined with the numerous elements and parameters, it does not reveal any pattern, for instance, at criterion level. However, this information is essential as it could facilitate discussions on possible harmonization or coordination at regional level. The number of elements assigned to numerous monitoring frequencies seems to indicate that MS have reported monitoring programmes that are already set under other obligations (e.g., WFD or RSCs), but not well coordinated. Therefore, to be useful, it would be needed that MS harmonise and report more clearly (giving specific timings) on monitoring frequency, including more details such as link to a particular criterion, spatial scope, taxa etc.

Finally, it is important to highlight that temporal and spatial inconsistencies are among the most common gaps identified by MS to generate adequate data.

8.3.4 Links with Art. 8 (Assessments)

According to the monitoring guidance, it is expected that typically only one 'monitoring purpose' category will be relevant per programme. However, for all descriptors, most MS include several 'purposes' for each programme, which, as said above, does not provide useful information.

Overall, it seems that the reported information under Art. 11 does not provide sufficient information to address Art. 8 assessment of state/impacts, while it seems to be more adequate for addressing Art. 8 assessment of pressures at sea and pressure at source. For instance, for D2, 88% of analysed MS collect monitoring data for pressures/activities, while the 58% do so for environmental state/impact. For D7, however, monitoring in place seems to be sufficient to address both the assessment of state/impacts and assessment of pressures, at least for some of the features and/or elements relevant for this descriptor. Although in some cases the insufficiency of information might be related to reporting issues (as explained above), based on previous experience and review of other MS's reports for MSFD (namely for Art. 8, 9, and 10)[17], it can be presumed that most current gaps are mainly linked to the lack of agreed approaches or methodological standards to address the assessment of the different criteria/descriptors.

It would be advisable to work towards the clear identification of monitoring gaps for the different criteria/descriptors and include them in the priority work items to be addressed within the existing Technical Groups and Expert Networks. Setting expert networks where missing for specific descriptors could also contribute to agreement/harmonization at EU level.

8.3.5 Links with Art. 9 (GES determination)

Overall, it seems that the coverage of elements, parameters and criteria is not complete and moreover it is quite variable among MS for all descriptors. Higher coverage can be found for descriptor/criteria that fall under 'superior' or 'more mature' pieces of legislation (e.g., CFP for D3, WFD for D5 and Food Regulation for D9) and some elements clearly specified in the GES Decision (e.g., WFD PS under D8). For instance, monitoring methods for D3 are largely based on the CFP, which is a mature EU Policy with well-established data collection frameworks and protocols. Hence, it can be assumed that reporting gaps should not reflect monitoring gaps and the monitoring of 'D3: Commercial species' is generally adequate to assess GES, as long as this assessment is based on D3C1 and D3C2 alone, as is the current modus operandi. Nevertheless, in general variability is still high for most descriptors, sometimes even within the same marine region (as described in sections 4.1.1.1-4.1.41 above), and there are still gaps in understanding which elements/parameters should be monitored, especially where there are no long well-established programmes.

Therefore, there seems to be a need for agreed GES definitions across EU as well as for further work within the MSFD Technical groups and Experts Networks to clearly define which criteria elements/parameters should be used to assess GES.

8.3.6 Links with Art. 10 (Environmental Targets)

For all descriptors, a significant number of MS have indicated that monitoring is not yet adequate to cover the proposed targets. Even in some of those cases where MS have declared adequacy, the evaluation of the MS reports for Art. 8, 9 and 10[8], highlighted there are still many gaps in the understanding of common targets (e.g., the targets are so general that cannot be linked to specific monitoring or not all targets reported under Art. 10 are addressed in the monitoring programmes). There is a tendency for MS to report under Art. 11 the same level of coverage for all MSFD articles (namely 8, 9, 10 and 13). However, given the different level of maturity across these four Articles, it would be expected to have less adequate monitoring related to targets (and measures) compared to Art. 8 (but is not always the case).

It seems clear that there are still gaps in understanding the conceptual approaches to set targets. Reporting on monitoring will be able to provide enough information to assess progress with targets only when Art. 8, 9 and 10 reporting is consistent and coherent (e.g., when targets are specific and clearly linked to particular criteria elements/parameters).

([17]) https://mcc.jrc.ec.europa.eu/main/dev.py?N=18&O=460

8.3.7 Links with Art. 13 (Measures)

Overall, the monitoring programmes do not provide sufficient data to assess the progress with measures. 'Effectiveness of measures' is not the monitoring purpose for a number of criteria/descriptors and many MS have declared that monitoring is not yet adequate to cover the progress with the measures. As for the targets, measures are in some case very generic, broadly related with impact of human activities and not relevant or specific to the descriptor under review.

It would be advisable to provide guidance regarding what MS should report for monitoring related to measures (pursuant to Art. 13) in order to enable a clear link between measures and the metrics used in monitoring (and assessment).

8.3.8 Data accessibility

Most of the links provided by MS under 'DataAccess' are not connected to a specific dataset, i.e., they mostly lead to a generic webpage or a pdf report (as seen in Figure 83 above). Indeed, for some descriptors (e.g., D3) no MS provided a link that directly lead to a dataset as *.xml* file and the descriptor with the highest number of MS providing accessible links is D8, with only the 58% of MS. The fact that not all data are accessible does not allow for a deeper analysis of the harmonisation of methods, parameters, but also frequency and extent of monitoring programmes. Monitoring data and methods, especially when linked to several reporting obligations (EU or regional) should ideally be accessed and collected regularly to feed the policy needs, which in turn should be continuously harmonised.

Efforts should be made to improve the findability and accessibility to the original data (and metadata). The collection of MSFD data through a single data portal (e.g., EMODnet) or the federation of existing data initiatives could facilitate the process.

Moreover, MS often report many different links in the same data entry and also slightly different links that probably refer to the same dataset (e.g., ICES-related links under D3). The reporting would be improved by having a single link that leads straight to the dataset. In case additional steps are needed to find, access and reuse the data, those could be clearly and concisely stated under 'DataManagement'.

8.3.9 Regional coordination

Although a number of EU (e.g., from HD, WFD, CFP) and regionally agreed (mostly from OSPAR and HELCOM) monitoring methods exist, and are in use by some MS, most MS in each region have indicated to apply national-specific or 'other' monitoring methods.

Harmonisation is still needed on the reported/realised regional cooperation in monitoring and reporting (in particular for descriptors like D4 and D7).

8.4 Coherence with other policies

The reporting should inform on which other EU policies and international agreements (including RSC), the monitoring programme contributes. MS have indicated several policies and frameworks relevant for the monitoring of the different descriptors, although not in a consistent way. For instance, the International Convention for the Control and Management of Ships' Ballast Water and Sediments (IMO-BWM) is relevant for D2C1, but it is only reported by 4 MS in the Baltic and 1 MS in the Atlantic. For D7, only half of MS indicated a relevant link between D7 monitoring and the WFD, of which only 4 MS explicitly defined the connection between the two directives. Likewise, few MS have indicated with some level of detail the link between D11 monitoring under the MSFD and other programmes, namely those established within HELCOM and OSPAR.

As for the directives already referenced in the GES Decision, there are differences between descriptors. For instance, for D2, the Invasive Alien Species Regulation (EU-IASR) is reported by 5 MS (DK, EE, FI, LV, SE) in the Baltic, 4 MS (BE, DK, ES, SE) in the Atlantic regions and only 2 MS (ES, IT) in the Mediterranean. The main monitoring program for commercial species, 'EU-CFP-DCF' (Data Collection Framework Multi-Annual Plan of the Common Fisheries Policy), is reported by all MS under D3, either on its own or in combination with other programs. For D5 and D8, monitoring is reported to be mostly linked to the WFD and to the Foodstuffs Regulation (EU-FSR) for D9. For D1, the majority of the MS made reference to the established monitoring programme from the HD, BD and CFP. Nevertheless, efforts are still needed to align those directives with MSFD

assessments.

8.5 Future monitoring - Needs for technical work

The analysis of MS' reports has allowed the identification of monitoring gaps and limitations. The main issues and needs for further work and monitoring concerning the different descriptors are summarized here:

- For D1, the monitoring of missing criteria should be considered in the updates of the monitoring programmes and better links with relevant policy (e.g., CFP and HD) should be pursued, in close collaboration with the RSCs, in order to achieve synergies in the monitoring of species that have distribution beyond the MS national jurisdiction (for marine turtles, some common guidelines and practical way to combine data from different monitoring methods have been developed by a group of experts from OSPAR, UNEP/MAP and MSFD Biodiversity expert network and will be soon published). Overall, MS need to agree on the GES criteria, thresholds and integration rules as foreseen by the Art. 8, 9 and 10. Moreover, MS need to agree on harmonised measures to tackle the pressures and impacts. When these will be in place then the monitoring requirements and consequently the reporting format can be set and fixed.
- For D1-Pelagic Habitats, MS have highlighted that remote sensing technologies can provide high resolution and continuous datasets covering larger spatial scale of the pelagic habitat and higher sampling frequencies than in-situ sampling. Thus, satellite observations are considered for future monitoring approaches. Additionally, new technologies such as those based on the optical-image-molecular data analysis are needed to improve the taxonomical resolution covering the whole size-trophic spectra of biological communities but are not considered yet for monitoring purposes. Progress towards GES are limited by the confined network of sampling stations (e.g., coastal areas) and the coarse interpolation of GES assessment at broad habitat types within Marine Reporting Units that do not represent the variability of pelagic habitat. Common monitoring methods and joint sampling campaigns should be promoted across marine regions for improving the harmonization and the data comparison across MS. The pelagic habitat experts of the MSFD Biodiversity EN have recently started to work together and harmonise PH assessment and monitoring.
- For D2, considerable work needs to be done to improve monitoring coordination, which requires collaboration across MS in subregional and regional levels. Monitoring frequency, temporal and spatial scopes are very scattered, and require detailed analysis and their harmonization. It would be suggested stepping up the implementation of D2 by enhancing coordination and data (including metadata) sharing. The proposed D2 core group when established can contribute to these objectives. Moreover, monitoring of measures and targets is particularly deficient and requiring additional work. Exemption to measures related to a pathway (i.e., Suez Canal) should not exempt from measures the pathways responsible for species secondary spread. This should be addressed by measures, which are monitored.
- For D3, criterion D3C3 appears to be lagging compared to D3C1 and D3C2 in terms of monitoring and/or reporting. A similar conclusion came from the analysis of the 2018 Art.8, 9 and 10 reports. This suggests that D3C3 might need to be re-worked and/or re-formulated, in order to become more operational. The spatial extent of populations of commercial species rarely adhere to national EEZs. Hence, MS-level reporting on the populations monitored is not particularly informative for D3, in terms of assessing the adequacy of monitoring coverage. Rather, to assess if the monitoring of populations of commercial species is adequate, the information could be given as the proportion of the stock extent covered by the coordinated monitoring of all relevant MS.
- For D7, more specific indications should be provided to MS, defining specifically and unambiguously which are the most relevant elements and parameters to assess hydrographic conditions. As well, indications on the frequency of monitoring of each relevant element or parameter should be provided. This would allow developing more harmonized monitoring methods across MS for the assessment of the baseline hydrographic conditions (necessary for MS that still haven't done so), the identification of their possible alterations, and the definition of the extent of such alterations.
- For D8, efforts should be made to harmonise the consideration of elements and parameters as well as to extend monitoring to offshore areas. The understanding on how to monitor and use D8C2 in the overall D8 assessment is also needed.
- Regarding D9, efforts are needed to improve the traceability of the samples in order to use data from Foodstuffs Regulation for MSFD purposes.

- For D10, some MS reported in their monitoring programmes the need and interest to develop baselines and TV from the data generated. In this sense, the MSFD TG ML is working on the development of baselines and further TV based on the information reported by the MS through the EMODnet platform. This work would complement the work done for the determination of beach litter baselines and the definition of the TV for macro litter on coastline agreed and adopted by MSCG[18]. It is, therefore, recommended to continue contributing to the joint work developed within the TG ML, particularly on criteria with lower coverage (D10C2, D10C3 and D10C4). In addition, the implementation of the Joint List of Litter Categories[19] is of importance for macro litter data comparability and interpretation of the data.
- For D11, several MS claimed that, given the recent start of underwater noise monitoring, data are not sufficient to set baselines and/or to assess measures related with this descriptor. It is recommended that standardized methods for monitoring are utilized on the long term in order for MS to produce regular measurements of underwater noise. Likewise, threshold values should be developed, along with indicators for other forms of energy. The main issue related with the identification of threshold values is related with the assessment of what level of anthropogenic underwater noise could lead to effects at the population or ecosystem level, other than the individual specific effects. The implementation of noise registers within MS or at regional level should be encouraged where lacking. Moreover, the contribution of private companies or the military on documenting their noise-producing activities should be assured in order to keep adequate records of all the possible noise sources within the marine regions. The integration of different acoustic data sources as well as the use of opportunistic data, where available, are also encouraged.

8.6 Progress from 2014

Even though gaps reported in 2014 have been compiled and analysed as far as possible for some descriptors, the way in which monitoring programmes were reported in 2014 does not allow a proper evaluation of their potential fulfillment. Many entries from the 2014 reporting were missing or reported differently in 2020 and as such any comparison is incomplete. Although such a comparison would lead to a more robust evaluation of the progress in the monitoring programmes across EU, this was not considered in the building of the reported structure, which led to incomparable datasets. This is expected to be resolved in the coming reporting cycles.

In particular, for D1, the comparison between the 2014 and 2020 reporting for Art. 11 could not be performed with the *.xls* files provided by Marine WISE Biodiversity, because the entries in the two reporting files have different structure and correspond to different hierarchical organization. Any attempt to compare them would be misleading. In 2014, JRC compiled three *.xls* files from the SQL database that hosted the MS' *.xml* files (from EIONET). Analogous information was extracted from the paper reports and the analysis concluded with a technical report (Palialexis et al. 2021)[20] to improve the reporting guidance for monitoring and a publication with key findings for the EU biodiversity monitoring[21]. The three *.xls* files were organized according to the structure of the 2014 reporting at:

- General information, where MS provided broad information for the MSFD Descriptors as a whole and their monitoring programmes;
- Monitoring programmes, where MS organised their existing or new monitoring programmes according to the assessment needs for each of the MSFD Descriptors (i.e. each ecosystem component - marine mammals, sea birds, etc.); and
- Monitoring sub programmes, where the monitoring programmes were split into sub programmes to cover more detailed technical information, which was organised according to the reporting guidance document.

In 2020, the reporting was made following a simpler approach broadly by following a single dimensional

([18]) Van Loon, W., Hanke, G., Fleet, D., Werner, S., Barry, J., Strand, J., Eriksson, J., Galgani, F., Gräwe, D., Schulz, M., Vlachogianni, T., Press, M., Blidberg, E. and Walvoort, D. 2020. A European threshold value and assessment method for macro litter on coastlines, EUR 30347 EN, Publications Office of the European Union, Luxembourg, ISBN 978-92-76-21444-1, doi:10.2760/54369, JRC121707

([19]) Fleet, D., Vlachogianni, Th. and Hanke, G., 2021. A Joint List of Litter Categories for Marine Macrolitter Monitoring. EUR 30348 EN, Publications Office of the European Union, Luxembourg, ISBN 978-92-76-21445-8, doi:10.2760/127473, JRC121708

([20]) Palialexis A., V. Kousteni, L. Boicenco, L. Enserink, K. Pagou, U-L. Zweifel, F. Somma, A. Cheilari, D. Connor, 2021b. Monitoring biodiversity for the EU Marine Strategy Framework Directive: Lessons learnt from evaluating the official reports, Marine Policy, Volume 128, doi.org/10.1016/j.marpol.2021.104473

([21]) Palialexis, A., V. Kousteni and F. Somma, 2019. In-depth assessment of the Member States' reporting for the Marine Strategy's biodiversity monitoring, Publications Office of the European Union, Luxembourg, ISBN 978-92-76-07986-6, doi:10.2760/051785

approach around each monitoring programme, which in principle forced the MS to merge the former two levels, which caused inconsistencies in the reported entries, especially for a one-to-one comparison. When comparing the three *.xls* files of the 2014 with the ones of 2020 it was concluded that the information is not analogous and comparable, since the monitoring programmes entries are not equally represented in the three datasets. The 2020 reporting of monitoring programmes followed a simpler approach, however the MS were required to adapt many established monitoring programmes that were reported in 2014, and also to take into account the entry of the 2017 GES Decision, to the new reporting format. Links across the two reporting cycles were not always provided.

9 Annexes

9.1 Annex I. Elements and parameters reported for the different descriptors/criteria

The acronyms used in the following tables are shown in the list of acronyms on page 273.

Table A1. Parameters used for monitoring D2C1.

Element	BE	DE	DK	EE	ES	FI	FR	HR	IE	LT	LV	NL	PL	RO	SE	SI
Not Applicable	pre	pre	pre	abu, biom, pre, spp-c	abu, abu-rel, biom, dist-p, dist-s, pre	pre	pre	pre	pre	pre	abu, biom, dist-s, pre	inc	pre	pre	pre	abu

Table A2. Elements and parameters used for monitoring D2C2.

Element	CY	DK	EE	ES	FI	FR	IT	LT	PL	RO	SE	SI
Acartia (Acanthacartia) tonsa											abu, biom, ext, oth	
Acrothamnion preissii				abu, abu-rel, biom, dist-p, dist-s, pre								
Agarophyton vermiculophyllum		abu, biom, ext, oth										
Alexandrium minutum												
Alkmaria romijni											abu, biom	
Amphibalanus improvisus											abu, biom, ext, oth	
Antithamnionella ternifolia												
Arcuatula senhousia												abu, dist-p
Asparagopsis armata				abu, abu-rel, biom,								
Asparagopsis taxiformis												
Aurelia coerulea												

Element	CY	DK	EE	ES	FI	FR	IT	LT	PL	RO	SE	SI
Austrominius modestus		abu, biom, ext, oth		dist-p, dist-s, pre								
Bacteriastrum hyalinum		abu, biom, ext, oth										
Balanus trigonus				abu, abu-rel, biom, dist-p, dist-s, pre								
Beania mirabilis												
Benthic habitats - macrobenthic communities			abu, biom, oth									
Benthic habitats - macrophyte communities												
Beroe ovata											abu, biom, ext, oth	
Biddulphia sinensis		abu, biom, ext, oth					abu					
Biuve fulvipunctata	abu, biom, ext											
Bivetiella cancellata				abu, abu-rel, biom, dist-p, dist-s, pre								
Blackfordia virginica												
Boccardia proboscidea												
Boccardia semibranchiata												
Boccardiella ligerica											abu, biom, ext, oth	
Bonnemaisonia hamifera		abu, biom, ext, oth									abu, biom, ext, oth	

Element	CY	DK	EE	ES	FI	FR	IT	LT	PL	RO	SE	SI
Bostrycapulus odites												
Botrylloides leachii												
Botrylloides violaceus												
Botryllus schlosseri												
Botryocladia wrightii												
Brachidontes pharaonis	abu, biom, ext											
Branchiomma bairdi				abu, abu-rel, biom, dist-p, dist-s, pre								
Branchiomma luctuosum												
Bugula neritina												
Bugulina fulva												
Bugulina simplex												
Bugulina stolonifera												
Bursatella leachii												
Calappa pelii												
Callinectes sapidus	abu, biom, ext											
Calyptospadix cerulea												
Caprella mutica		abu, biom, ext, oth									abu, biom, ext, oth	
Caprella scaura												
Carassius gibelio									abu			
Caulerpa cylindracea	abu, biom, ext			abu, abu-rel, biom, dist-p, dist-s, pre								
Caulerpa racemosa												
Caulerpa taxifolia	abu, biom, ext											
Cephalothrix simula												

Element	CY	DK	EE	ES	FI	FR	IT	LT	PL	RO	SE	SI
Ceramium cingulatum												
Cercopagis pengoi					abu, ext							
Cerithium scabridum				abu, abu-rel, biom, dist-p, dist-s, pre								
Chaetopleura angulata												
Chama pacifica	abu, biom, ext											
Charybdis (Charybdis) feriata				abu, abu-rel, biom, dist-p, dist-s, pre								
Chondria coerulescens												
Chorizopora brongniartii												
Clavelina lepadiformis												
Clavelina oblonga												
Clytia hummelincki												
Clytia linearis												
Codium fragile		abu, biom ext, oth										
Colaconema codicola												
Colpomenia peregrina		abu, biom ext, oth										
Cordylophora caspia											abu, biom ext, oth	
Corella eumyota				abu, abu-rel, biom, dist-p, dist-s, pre								

Element	CY	DK	EE	ES	FI	FR	IT	LT	PL	RO	SE	SI
Coscinodiscus wailesii		abu, biom ext, oth										
Coscinospira hemprichii				abu, abu-rel, biom, dist-p, dist-s, pre								
Crambe crambe												
Crassostrea gigas[22]											abu, biom ext, oth	
Crepidula fornicata		abu, biom ext, oth		abu, abu-rel, biom, dist-p, dist-s, pre							abu, biom ext, oth	
Crepipatella dilatata												
Cryptosoma cristatum												
Cystodytes dellachiajei												
Cystodytes philippinensis												
Dasya baillouviana		abu, biom ext, oth									abu, biom	
Dasya sessilis												
Dasysiphonia japonica		abu, biom ext, oth									abu, biom ext, oth	
Dendostrea folium	abu, biom ext, oth											
Desdemona ornata				abu, abu-rel, biom,								
Desmarestia viridis												

([22]) Accepted name *Magallana gigas*

Element	CY	DK	EE	ES	FI	FR	IT	LT	PL	RO	SE	SI
				dist-p, dist-s, pre								
Diadema setosum	abu, biom ext											
Diadumene lineata		abu, biom ext, oth		abu, abu-rel, biom, dist-p, dist-s, pre								
Dictyota cyanoloma												
Didemnum vexillum												
Didymosphenia geminata												
Diplosoma listerianum												
Dipolydora tentaculata												
Dispio uncinata												
Distaplia bermudensis												
Dyspanopeus sayi												
Ecteinascidia turbinata												
Electra pilosa												
Ensis leei		abu, biom ext, oth										
Eocuma dimorphum												
Erinaceusyllis serratosetosa												
Eriocheir sinensis			abu, biom									
Escharina vulgaris												
Eucheilota menoni												
Eucheilota paradoxica												
Eudendrium carneum												
Eurythoe complanata												
Eurythoe laevisetis												

Element	CY	DK	EE	ES	FI	FR	IT	LT	PL	RO	SE	SI
Fauveliopsis glabra												
Fenestrulina malusii		abu, biom ext, oth										
Fibrocapsa japonica												
Ficopomatus enigmaticus											abu, biom, ext, oth	
Filellum serratum												
Fistularia commersonii	abu, biom, ext											
Fouling												
Fucus spiralis				abu, abu-rel, biom, dist-p, dist-s, pre								
Fulvia fragilis												
Fundulus heteroclitus heteroclitus												
Gammarus tigrinus		abu, biom, ext, oth										
Ganonema farinosum	abu, biom, ext			abu, abu-rel, biom, dist-p, dist-s, pre								
Gibbula albida												
Godiva quadricolor												
Goniadella gracilis												
Goniotrichopsis sublittoralis												
Gracilaria vermiculophylla												
Gracilipurpura rostrata												
Grallatoria reptans												
Grateloupia imbricata												
Grateloupia subpectinata		abu, biom										

Element	CY	DK	EE	ES	FI	FR	IT	LT	PL	RO	SE	SI
		ext, oth										
Grateloupia turuturu												
Gymnodinium catenatum				abu, abu-rel, biom, dist-p, dist-s, pre								
Gymnophycus hapsiphorus												
Halimeda incrassata												
Haliscera bigelowi												
Halophila stipulacea	abu, biom, ext											
Haminoea japonica				abu, abu-rel, biom, dist-p, dist-s, pre								
Hemigrapsus sanguineus		abu, biom, ext, oth									abu, biom, ext, oth	
Hemigrapsus takanoi				abu, abu-rel, biom, dist-p, dist-s, pre							abu, biom, ext, oth	
Herdmania momus	abu, biom, ext											
Hesionura serrata				abu, abu-rel, biom, dist-p, dist-s, pre								
Heterosigma akashiwo		abu, biom, ext, oth										

Element	CY	DK	EE	ES	FI	FR	IT	LT	PL	RO	SE	SI
Heterotentacula mirabilis				abu, abu-rel, biom, dist-p, dist-s, pre								
Hexapleomera robusta												
Hexaplex trunculus												
Hydroides dirampha							abu					
Hydroides elegans												
Hypnea spinella	abu, biom, ext											
Hypnea valentiae												
Ianiropsis serricaudis							abu					
Jassa marmorata		abu, biom, ext, oth		abu, abu-rel, biom, dist-p, dist-s, pre								
Jellyella tuberculata				abu, abu-rel, biom, dist-p, dist-s, pre								
Karenia mikimotoi		abu, biom, ext, oth									abu, biom, ext, oth	
Lagocephalus sceleratus	abu, biom, ext											
Laurencia caduciramulosa				abu, abu-rel, biom, dist-p, dist-s, pre								
Leiochrides australis												
Leitoscoloplos kerguelensis												
Lepidonotus carinulatus												
Lomentaria hakodatensis												
Lophocladia lallemandii												
Lumbrineris perkinsi							abu					
Lysidice collaris												

Element	CY	DK	EE	ES	FI	FR	IT	LT	PL	RO	SE	SI
Magallana gigas		abu, biom, ext, oth										
Marenzelleria spp. (neglecta & viridis)		abu, biom, ext, oth									abu, biom, ext, oth	
Marginella glabella				abu, abu-rel, biom, dist-p, dist-s, pre								
Mediomastus capensis												
Melanothamnus harveyi		abu, biom, ext, oth										
Mercenaria mercenaria												
Merhippolyte ancistrota												
Metasychis gotoi												
Microcosmus exasperatus	abu, biom, ext											
Microcosmus squamiger				abu, abu-rel, biom, dist-p, dist-s, pre								
Microporella ciliata												
Mnemiopsis leidyi		abu, biom, ext, oth								biom	abu, biom, ext, oth	Abu, dist-p
Mobile epifauna												
Molgula manhattensis		abu, biom, ext, oth		abu, abu-rel, biom, dist-p, dist-s, pre							abu, biom, ext, oth	
Monocorophium acherusicum				abu, abu-rel,								
Monocorophium sextonae												

Element	CY	DK	EE	ES	FI	FR	IT	LT	PL	RO	SE	SI
Mya arenaria		abu, biom, ext, oth		biom, dist-p, dist-s, pre							abu, biom, ext, oth	
Neanthes agulhana												
Necora puber												
Neogobius melanostomus		abu, biom, ext, oth	abu, biom		abu			abu	abu		abu, biom, ext, oth	
Neomysis integer				abu, abu-rel, biom, dist-p, dist-s, pre								
Neopseudocapitella brasiliensis												
Nereis jacksoni												
Nicidion cariboea												
Not Applicable						abu, dist-s						
NotApplicable						abu, dist-s						
Notomastus aberans				abu, abu-rel, biom, dist-p, dist-s, pre								
Notomastus mossambicus												
Novafabricia infratorquata												
Oculina patagonica												
Oithona davisae												
Oithona similis												
Oncorhynchus mykiss		abu, biom, ext, oth									abu, biom	
Ostreopsis siamensis				abu, abu-rel, biom, dist-p, dist-s, pre								
Pachymeniopsis lanceolata												
Pagurus mbizi												

Element	CY	DK	EE	ES	FI	FR	IT	LT	PL	RO	SE	SI
Palaemon elegans					abu						abu, biom, ext, oth	
Palaemon macrodactylus				abu, abu-rel, biom, dist-p, dist-s, pre								
Palisada maris-rubri												
Paracaprella pusilla												
Paracartia grani							abu					
Paracerceis sculpta												
Paradella dianae												
Paraleucilla magna												
Paraprionospio coora												
Penaeus japonicus												
Percnon gibbesi	abu, biom, ext											
Perinereis aibuhitensis												
Perophora japonica												
Petricolaria pholadiformis		abu, biom, ext, oth										
Phyllorhiza punctata												
Phytoplankton communities												
Pikea californica				abu, abu-rel, biom, dist-p, dist-s, pre								
Pinctada imbricata radiata	abu, biom, ext											
Pista unibranchia												
Plocamium secundatum												
Polyandrocarpa zorritensis												
Polycera hedgpethi												
Polycerella emertoni												
Polydora colonia												

Element	CY	DK	EE	ES	FI	FR	IT	LT	PL	RO	SE	SI
Polydora cornuta		abu, biom, ext, oth										
Polysiphonia atlantica												
Polysiphonia morrowii												
Pomacanthus maculosus												
Pomadasys incisus	abu, biom, ext											
Portunus segnis												
Potamopyrgus antipodarum		abu, biom, ext, oth		abu, abu-rel, biom, dist-p, dist-s, pre							abu, biom, ext, oth	
Predaea huismanii												
Prionospio pulchra												
Processa macrodactyla												
Prorocentrum cordatum		abu, biom, ext, oth										
Protoreaster nodosus				abu, abu-rel, biom, dist-p, dist-s, pre								
Pseudochattonella verruculosa		abu, biom, ext, oth										
Pseudo-nitzschia multistriata				abu, abu-rel, biom, dist-p, dist-s, pre			abu					
Pseudopolydora paucibranchiata												
Puellina innominata[23]												
Pylaiella littoralis												

([23]) Accepted name *Cribrilaria innominata*

Element	CY	DK	EE	ES	FI	FR	IT	LT	PL	RO	SE	SI
Pyropia koreana												
Pyropia suborbiculata												
Rangia cuneata											abu, biom, ext, oth	
Rapana venosa				abu, abu-rel, biom, dist-p, dist-s, pre								
Reptadeonella violacea												
Rhithropanopeus harrisii		abu, biom, ext, oth	abu, biom		abu						abu, biom, ext, oth	
Rhopilema nomadica	abu, biom, ext											
Ruditapes philippinarum				abu, abu-rel, biom, dist-p, dist-s, pre								
Rugulopteryx okamurae												
Sargassum muticum		abu, biom, ext, oth									Abu, biom	
Scageliopsis patens												
Schizoporella errata												
Schizoporella unicornis												
Scinaia acuta												
Scruparia ambigua												
Scytosiphon dotyi												
Sigambra parva												
Siganus luridus	abu, biom, ext											
Siganus rivulatus												
Siphonaria pectinata				abu, abu-rel, biom, dist-p, dist-s, pre								
Sparus aurata												

Element	CY	DK	EE	ES	FI	FR	IT	LT	PL	RO	SE	SI
Spermothamnion repens var. flagelliferum											abu, biom	
Sphaeroma walkeri				abu, abu-rel, biom, dist-p, dist-s, pre								
Spirorbis (Spirorbis) marioni												
Spondylus spinosus	abu, biom, ext											
Spongoclonium caribaeum				abu, abu-rel, biom, dist-p, dist-s, pre								
Stenothoe georgiana												
Steromphala adansonii												
Steromphala cineraria												
Streblospio benedicti		abu, biom, ext, oth										
Styela clava				abu, abu-rel, biom, dist-p, dist-s, pre								
Styela plicata												
Stypopodium schimperi	abu, biom, ext											
Syllis pectinans												
Synidotea laticauda												
Tayuva lilacina												
Teredo navalis		abu, biom, ext, oth										
Theora lubrica				abu, abu-rel, biom, dist-p, dist-s, pre								
Tonicia atrata												
Tricellaria inopinata												abu, dist-p
Tritia neritea												
Ulva australis												

Element	CY	DK	EE	ES	FI	FR	IT	LT	PL	RO	SE	SI
Ulva lactuca												
Undaria pinnatifida												
Urosalpinx cinerea												
Vertebrata fucoides												
Womersleyella setacea												
Xenostrobus securis												
Zebrasoma flavescens												
Zooplankton communities												

Table A3. Elements and parameters used for monitoring D2C3.

Elements	LT	RO
Mnemiopsis leidyi		oth
Neogobius melanostomus	ext	

Table A4. Feature categories reported by each MS for the D3 Criteria. MS reporting non-typical feature categories (i.e., other than 'FishCommercial') have been highlighted in red. The correct 'Feature' category for D3 ('FishCommercial') has been highlighted in green.

Feature	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
ActivExtrLivingFishHarv											+		+					
FishCoastal			+										+					
FishCommercial	+	+	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+
FishDemersalShelf			+										+					
FishPelagicShelf			+										+					
PresBioExtractSpp																	+	

Table A5. Elements reported by each MS for at least one of the three D3 Criteria.

Element	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
Aequipecten opercularis				+						+								
Alopias spp.				+														
Amblyraja radiata				+													+	
Ammodytes spp.			+	+				+						+			+	
Anarhichas lupus				+														
Anguilla anguilla			+	+		+	+							+			+	
Argentina silus				+										+			+	
Argentinidae				+														
Aristaeomorpha foliacea											+							
Aristeus antennatus						+												
Belone belone			+	+														
Brosme brosme				+										+				
Buccinum undatum				+														
Callista chione				+														
Cancer pagurus			+	+						+							+	
Capros aper				+						+								
Carcinus maenas				+						+								
Centrolabrus exoletus										+								
Cerastoderma edule										+								
Chamelea gallina						+					+							
Chelidonichthys cuculus				+						+								
Chelidonichthys lucerna			+	+						+								
Chelon labrosus				+														
Clupea harengus			+	+	+		+	+		+		+	+	+	+		+	
Conger conger				+						+								
Coregonus lavaretus							+											
Coryphaenoides rupestris								+									+	

Element	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
Crangon crangon			+	+														
Crystallogobius linearis				+														
Ctenolabrus rupestris				+													+	
Dalatias licha											+							
Dasyatis pastinaca										+								
Demersal fish community	+																	
Dicentrarchus labrax				+				+		+				+			+	
Dipturus batis				+														
Dipturus oxyrinchus										+								
Donax trunculus						+												
Eledone cirrhosa				+							+							
Eledone moschata											+							+
Engraulis encrasicolus			+	+		+		+	+		+					+		+
Ensis Magnus										+								
Ensis Siliqua										+								
Esox spp.							+											
Eutrigla gurnardus			+	+						+				+			+	
Gadus morhua			+	+			+	+		+		+	+	+	+		+	
Galeorhinus galeus				+						+								
Galeus melastomus											+							
Glyptocephalus cynoglossus				+						+				+			+	
Gymnammodytes cicerelus						+												
Gymnammodytes semisquamatus				+														
Helicolenus dactylopterus				+						+	+							
Hippoglossoides platessoides				+														
Homarus gammarus				+						+								
Illex coindetii				+						+	+							
Katsuwonus pelamis						+												
Labrus bergylta				+														
Lamna nasus				+														
Lepidorhombus boscii						+												
Lepidorhombus whiffiagonis				+		+		+		+				+				
Leucoraja											+							
Leucoraja circularis										+	+							
Leucoraja fullonica										+								
Leucoraja naevus				+						+								
Limanda limanda			+	+						+			+	+			+	
Loligo forbesii				+														
Loligo vulgaris		+		+														+
Lophius budegassa				+		+				+	+			+				
Lophius piscatorius				+		+		+		+				+			+	
Maja squinado										+								

Element	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
Melanogrammus aeglefinus				+				+		+				+			+	
Merlangius merlangus			+	+				+						+		+	+	
Merluccius merluccius				+		+		+	+	+	+						+	
Microchirus spp.				+														
Micromesistius poutassou				+		+		+		+				+			+	
Microstomus kitt			+	+										+			+	
Molva dypterygia				+				+						+				
Molva molva				+						+				+			+	
Mora moro										+								
Mullus barbatus		+				+		+	+		+					+		+
Mullus surmuletus		+		+		+					+							
Murex spp.											+							
Mustelus asterias										+								
Mustelus spp.				+							+							
Myliobatis aquila											+							
Mytilus edulis				+						+								
Necora puber										+								
Nephrops norvegicus				+		+		+	+	+	+			+			+	
Octopodidae				+														
Octopus vulgaris		+				+												
Ostrea edulis										+								
Pagellus acarne		+																
Pagellus bogaraveo										+								
Pagellus erythrinus		+																+
Pagrus pagrus		+																
Palaemon Serratus										+								
Palinurus elephas										+								
Pandalus borealis				+										+			+	
Paracentrotus lividus						+												
Parapenaeus longirostris						+					+							
Pecten jacobeus									+									
Pecten maximus										+								
Perca fluviatilis				+	+		+										+	
Phycis blennoides				+						+	+						+	
Platichthys flesus			+	+	+					+		+	+	+	+		+	
Platichthys solemdali					+													
Pleuronectes platessa			+	+				+		+			+	+			+	
Pollachius pollachius				+						+							+	
Pollachius virens				+				+		+				+			+	
Prionace glauca				+		+		+		+								
Raja asterias											+							
Raja brachyura				+						+								

Element	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
Raja clavata				+						+	+						+	
Raja microocellata										+								
Raja montagui				+						+								
Raja undulata										+								
Rutilus rutilus																	+	
Salmo salar				+	+		+											
Sander lucioperca				+	+		+										+	
Sarda sarda				+														
Sardina pilchardus				+		+			+	+	+							+
Sardinella aurita											+							
Scomber japonicus				+							+							
Scomber scombrus			+	+		+		+		+				+			+	
Scophthalmus maximus				+						+							+	
Scophthalmus maximus [Psetta maxima]			+											+				
Scophthalmus rhombus				+						+				+			+	
Scyliorhinus canicula				+						+	+						+	
Sepia officinalis		+		+							+							+
Serranus cabrilla		+																
Solea solea				+				+	+	+	+						+	+
Solea solea (sin. vulgaris)			+											+				
Sparisoma cretense						+												
Spicara smaris		+							+									
Spisula solida										+								
Sprattus sprattus			+	+	+		+			+		+	+	+	+	+	+	
Squalus acanthias				+				+		+	+			+		+	+	
Symphodus melops				+													+	
Thunnus alalunga		+				+		+		+								
Thunnus obesus						+												
Thunnus thynnus		+				+		+		+								+
Todarodes sagittatus				+														
Trachurus trachurus				+		+		+		+				+			+	
Trisopterus esmarkii				+										+			+	
Trisopterus luscus				+						+								
Trisopterus minutus				+														
Venerupis spp.						+												
Xiphias gladius		+		+		+		+										
Zeus faber				+						+								
Total	1	13	19	90	7	29	9	25	8	69	30	4	6	32	4	5	41	9

Table A6. Parameters reported for D5.

	Elements	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
D5C1	DIN			CONC-W	CONC-W	CONC-W	CONC-W	CONC-W	CONC-W	CONC-W	CONC-W	CONC-W	CONC-W	CONC-W	CONC-W	CONC-W	CONC-W	CONC-W	CONC-W
	DIP																		
	Hydrogen sulfide (H2S)																		
	NH4+		CONC-W		CONC-W								CONC-W	CONC-W	CONC-W			CONC-W	
	NO2-N																		
	NO3-N				CONC-W										CONC-W				
	Missing elements ('Not Applicable')			CONC-W, DEP, EMI							CONC-W, OTH	CONC-W, OTH							
	Nutrients	CONC-W																	
	POC						CONC-W											CONC-W	
	PON																		
	Salinity														CONC-W				
	Si(OH)4						CONC-W											CONC-W	
	Silicate (SiO4)		CONC-W		CONC-W	CONC-W		CONC-W					CONC-W	CONC-W					
	TN			CONC-W			CONC-W			CONC-W					MASS	CONC-W		CONC-W	CONC-W
	TOC - total organic carbon							CONC-W											
	TP		CONC-W	CONC-W	CONC-W	CONC-W	CONC-W			CONC-W			CONC-W	CONC-W	MASS	CONC-W			CONC-W
	WFD assessment nutrients	CONC-W																	
D5C2	CHL-a	CONC-W	CONC-W	CONC-W	CONC-W, OTH	CONC-W	CONC-W	CONC-W	CONC-W	CONC-W	CONC-W	CONC-W	CONC-W	CONC-W	CONC-W		CONC-W	CONC-W	CONC-W
	Missing elements ('Not Applicable')																		
	Remote sensing (CHL-a)	CONC-W																	
D5C3	Cyanobacteria			ABU, BIOM, DUR, OTH, SPP-C		DUR, EXT, FRE		EXT, OTH						EXT				DUR,EXT, FRE	
	Diatoms & Dinoflagellates																		
	Dinophysis spp.			CELL-C															
	Max conc. of blooming species					DUR, EXT,													DUR, EXT,

	Elements	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
						FRE													FRE
	Noctiluca scintillans																OTH		
	Missing elements ('Not Applicable')													EXT					
	Phaeocystis spp.			CELL-C															
	Phytoplankton communities						DUR,EXT, FRE			FRE								DUR, EXT, FRE	
	Prorocentrum spp.			CELL-C															
	Pseudo-nitzschia spp.																		
D5C4	CDOM				TRA													OTH	
	Photic limit			EXT, TRA	TRA					TRA									
	Scattering and absorption in the visible light																	TRA	
	Transparency				TRA	TRA	TRA		TURB				TRA			TRA	TRA	TRA	
D5C5	Dissolved oxygen (02)		CONC-W	CONC-W	CONC-W	CONC-W	CONC-W	CONC-W	CONC-W	CONC-W	CONC-W	CONC-W	CONC-W		CONC-W	CONC-W	CONC-W	CONC-W, OTH	CONC-W
	Missing elements ('Not Applicable')																		
D5C6	opportunistic macroalgae					OTH			ABU		ABU, OTH					COV, EXT	OTH	ABU, COV, EXT	ABU
D5C7	macrophyte communities					OTH			OTH		ABU, OTH		ABU, COV, EXT, OTH	ABU		COV, EXT		ABU, COV, EXT	ABU, OTH
	Circalittoral mixed sediment																		
	Circalittoral rock and biogenic reef																		
	Infralittoral mixed sediment																		
	Infralittoral rock and biogenic reef																		
D5C8	macrobenthic communities					ABU, EXT, OTH					OTH		OTH			ABU		ABU, OTH	ABU-REL, OTH

Table A7. Parameters reported for D7C1 elements. Some parameters are not listed in the MSFD Guidance Document 17 (sc: Strength of sea currents at a certain depth; it: ice thickness; st: Using salinity and temperature; t: time; msl: mean sea level; c: concentration; wh: wave height; cwt: Changes in water temperature).

Elements	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	SE	SI
Bathymetry					OTH						EXT		EXT	BATH		
Changes in current regime								EXT								
Changes in salinity regime								EXT								
Changes in seabed substrate								EXT								

Elements	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	SE	SI
Changes in thermal regime								EXT								
Changes in tide regime								EXT								
Changes in turbidity regime								EXT								
Changes in waves regime								EXT								
Current regime	EXT		DIST-S, VEL	EXT		EXT	EXT, SAL		EXT	EXT	EXT, VEL	OTH	EXT	VEL	EXT, OTH, VEL	OTH, sc
Dissolved carbon dioxide (pCO2)										EXT						
Dissolved oxygen (O2)												OTH				
Freshwater input						EXT										
Ice			DIST-S, DUR, TEM, EXT, OTH, it									OTH, it			EXT, OTH, it	
Mixing						EXT									EXT, OTH, st	
pH												OTH, PH				
Residence time						EXT				EXT, OTH, t					EXT, OTH, st	
Salinity			DIST-S, SAL			EXT	EXT, OTH		EXT	EXT	EXT	OTH	EXT	CONC-W	EXT, OTH, st	
Sea level			TID						EXT		EXT, TID			OTH, msl	EXT, OTH, TID	OTH
Seabed substrate and morphology		EXT		EXT	OTH, HAB-STRUCT					EXT	EXT					
Temperature			DIST-S, TEM			EXT	EXT		EXT	EXT, OTH	EXT	OTH	EXT	OTH, TEM	EXT, OTH, it, st	EXT
Transparency									EXT		EXT		EXT		EXT	
Turbidity (silt/sediment loads)				EXT		EXT				OTH, c	EXT, WAV		EXT		EXT	
Upwelling													EXT		EXT, OTH, st	
Water density															EXT, OTH	
Wave regime	EXT	EXT	WAV			EXT	EXT, SAL			EXT	EXT, WAV	OTH	EXT	WAV	EXT, OTH, WAV	OTH, wh

Elements	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	SE	SI
Not Applicable				EXT		EXT	EXT, cwt			EXT					OTH, TEM	
TOTAL	**2**	**2**	**6**	**4**	**2**	**9**	**5**	**7**	**5**	**9**	**9**	**7**	**8**	**6**	**13**	**4**

Table A8. Parameters reported for D7C2 elements. Some parameters are not listed in the MSFD Guidance Document 17 (esd: extent and spatial distribution of affected habitat; sca: Species composition and abundance or biomass of species; edd: Extent Distribution (pattern) Distribution (range); eea: Effects: Expert assessment; csw: changes in salinity and water flow; mm: Macrophytes and macrozoobenthos).

Elements	DK	EE	ES	FI	FR	LV	NL	RO	SE	SI
Baltic muddy bottoms of the aphotic zone						OTH, esd				
Circalittoral coarse sediment		OTH			EXT		EXT			
Circalittoral mixed sediment		OTH			EXT	OTH, esd				
Circalittoral mud		OTH			EXT	OTH, esd	EXT	EXT		
Circalittoral rock and biogenic reef		OTH			EXT	OTH, esd				OTH, sca
Circalittoral sand		OTH			EXT		EXT	EXT		
Current regime	OTH									
Infralittoral coarse sediment		OTH			EXT	OTH, esd			OTH, edd	OTH, sca
Infralittoral mixed sediment		OTH			EXT	OTH, esd				
Infralittoral mud		OTH			EXT			EXT	OTH, edd	OTH, sca
Infralittoral rock and biogenic reef		OTH			EXT	OTH, esd			OTH, edd	OTH, sca
Infralittoral sand		OTH			EXT	OTH, esd		EXT	OTH, edd	OTH, sca
Littoral rock and biogenic reef										OTH, sca
Littoral sediment										OTH, sca
Offshore circalittoral coarse sediment					EXT		EXT			
Offshore circalittoral mixed sediment					EXT					
Offshore circalittoral mud					EXT		EXT	EXT		
Offshore circalittoral rock and biogenic					EXT					
Offshore circalittoral sand					EXT		EXT			
Reefs									OTH, edd	
Sandbanks which are slightly covered by seawater all the time									OTH, edd	
Seabed substrate and morphology	OTH									
Turbidity (silt/sediment loads)	OTH									

Elements	DK	EE	ES	FI	FR	LV	NL	RO	SE	SI
Not Applicable	EXT		EXT, eea	eea, csw, mm						
TOTAL	**4**	**10**	**1**	**1**	**15**	**8**	**6**	**5**	**6**	**7**

Table A9. Elements (contaminants) and parameters (matrix) reported for D8C1. Priority Substances under the Water Framework Directive (WFD) are highlighted in bold. w: water; b: biota; s: sediment; oth: other (*Eggs of Sterna hirundo (BE and SE) and eggs of Haematopus (SE); **Atmospheric input; ***Total concentration in water; [p]Precipitation and airborne; [m]Macrophytes).

Elements	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI	TOTAL MS
All Contaminants				b							b, s							w, b, s	**3**
Environmental non UPBT contaminants - WFD non UPBT substances	w												b						**2**
Environmental UPBT contaminants - WFD UPBT substances	w												b						**2**
Metals/metalloids																			
Aluminium and its compounds				s								s			s		b, s, oth*		**4**
Antimony																	s		**1**
Arsenic and its compounds			w, s	b, s	w, b, s							w, s		w	w, b, s		b, s, oth*		**7**
Barium					w, b, s												s		**2**
Beryllium																	s		**1**
Cadmium and its compounds	b, s	b, s	w, b, s	b, s	w, b, s	b, s	w, b, oth**	b, s	w, s	w, b, s		w, b, s	b, s	w, b, s, mass, oth[p]	w, b, s	w, s	b, s, oth*		**16**
Calcium																	s		**1**
Chromium and its compounds			w, s	b, s	w, b, s		w, b, oth**	b, s	b, s	w		w, s		w	w	w, s	b, s, oth*		**12**
Cobalt														w			s		**2**
Copper and its compounds	s		w, s	b, s	w, b, s		w, b	b, s	w, b, s	b, s		w, b, s	b, s	w, b, mass	w, b, s, oth[m]	w, s	b, s, oth*		**14**
Iron and its compounds			w														s		**2**
Lead and its compounds	b, s		w, b, s	b, s	w, b, s	b, s	w, b, oth**	b, s	w, s	w, b, s		w, b, s	b, s	w, b, s, mass, oth[p]	w, b, s, oth[m]	w, s	b, s, oth*		**15**
Manganese and its compounds			w														s		**2**
Mercury and its compounds	b, s, oth*	b, s	w, b, s	b, s	w, b, s	b, s	w, b, oth**	b, s	b, s	w, b, s		w, b, s	b, s	w, b, s, mass, oth[p]	w, b, s, oth[m]		b, s, oth*		**15**
Molybdenum and its compounds																	s		**1**
Nickel and its compounds			w	b, s	w, b, s		w, b	b, s	w, b, s			w, s		w, oth[p]	w, b, oth[m]	w, s	b, s, oth*		**11**
Potassium																	s		**1**
Scandium																	s		**1**
Selenium and its compounds			w											w			b, s, oth*		**3**
Silver			w	b, s										w			b, s, oth*		**4**
Strontium																	s		**1**

Elements	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI	TOTAL MS
Thallium			w											w			s		**3**
Tin and its compounds					w, b, s							s					b, s, oth*		**3**
Titanium																	s		**1**
Tungsten																	s		**1**
Vanadium and its compounds																	s		**1**
Yttrium																	s		**1**
Zinc and its compounds	s		w, s	b, s	w, b, s		b	b, s	w, b, s	w, b, s		w, b, s	b, s	w, b, mass	w, b, s, oth[m]		b, s, oth*		**13**
Zirconium																	s		**1**
Organic pollutants																			
1,1,1-Trichloroethane																	s		**1**
1,2-Dichloroethane			w		w				w			w, s		w	w				**6**
2,4-dichlorophenoxyacetic acid, 2-4 D			w							w									**2**
2,3-dimethyl-phenol					w, b, s	s													**2**
2,6-Dimethyl phenol					w, b, s	s													**2**
2-methyl-phenol					w, b, s	s													**2**
3,4-dimethyl-phenol					w, b, s	s													**2**
3,5-Dimethyl phenol					w, b, s	s													**2**
17-Alpha-ethinylestradiol (EE2)															w				**1**
Aclonifen			w						w			w, s		w					**4**
Alachlor			w		w, b, s	s			w			w, s		w	w		s		**8**
Ametryn			w																**1**
Atrazine			w		w, b, s	s			w			w, s		w	w		s		**8**
Azinphos-ethyl			w											w					**2**
Azinphos-methyl			w											w					**2**
Bentazone			w											w					**2**
Benzene			w		w				w	w		w, s		w	w		s		**8**
Bifenox			w						w					w					**3**
Bromacil			w																**1**
Bromoxynil			w																**1**
Carbon tetrachloride			w						w			w, s		w	w				**5**
Chlordane				b								b, s							**2**
Trans-chlordane																	s		**1**
trans-nonachlor																	s		**1**
Chlordecone (Kepone)												b, s							**1**
Chlorfenvinphos			w		w, b, s	s			w			w, s		w	w		s		**8**
Chloridazon			w																**1**
Chloroalkanes C10-13					s				s			w, s		w	w		s		**6**

Elements	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI	TOTAL MS
Chloroalkanes C14-17																	s		**1**
Chlorotoluron			w											w					**2**
Chlorpyrifos			w		w, b, s	s			w			w, s		w	w		s		**8**
m-/p-Cresol					w, b, s														**1**
Cybutryne			w						w			w, s		w			s		**5**
Cypermethrin									s	w		w, s		w					**4**
p,p'-DDT + p,p'-DDD + p,p'-DDE	oth*								w							w, s			**3**
Total DDT (DDT, p,p' + DDT, o,p' + DDE, p,p' + DDD, p,p')			w		w, b, s		b							w	w				**5**
o,p'-DDD				b															**1**
p,p'-DDD						b, s										w, s	s		**3**
o,p'-DDE				b															**1**
p,p'-DDE			b	b		b, s		b, s								w, s	s		**6**
DDT, o,p'				b		b, s						w, b, s	b, s		b, s		s		**6**
DDT, p,p'				b	w, b, s	b, s						w, b, s	b, s		w, b, s	w, s	s		**8**
Di(2-ethylhexyl)phthalate (DEHP)			w	s	w, b, s				w, s			w, s		w	w		s		**8**
Butyl benzyl phthalate (BBP)														w			s		**2**
Dibutylphthalate				s													s		**2**
Dihexyl phthalate																	s		**1**
Di-iso-butyl phthalate				s													s		**2**
Dimethyl phthalate				b, s			w												**2**
Di-n-octyl phthalate				s															**1**
Diisononyl phthalate																	s		**1**
Dichloromethane			w		w, b, s				w			w, s		w	w				**6**
Dichlorprop (2,4-DP)			w											w					**2**
Dichlorvos			w						s			w, s		w					**4**
Diclofenac			w												w				**2**
Dicofol			w, b				b		b, s			w, b, s		w	w				**6**
Diflufenican			w																**1**
Dimethoate			w											w					**2**
Diuron			w		w, b, s				w			w, s		w	w		s		**7**
Endosulfan					w, b, s				w			w, b		w	w, b, s		s		**6**
alpha-Endosulfan			w									s							**2**
beta-Endosulfan			w									s							**2**
Endosulfan sulfate																	s		**1**
Epoxiconazole			w																**1**
Ethylbenzene														w			s		**2**
Etrimfos			w																**1**

Elements	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI	TOTAL MS
Fenitrothion			w																**1**
Fenthion			w																**1**
Flufenacet			w																**1**
Hexabromocyclododecanes (HBCDD)					b, s		b, s		b, s	s		w, b, s			b		b, s, oth*		**7**
1,3,5,7,9,11-Hexabromocyclododecane			w							w									**2**
alpha-Hexabromocyclododecane			b	b															**2**
beta-Hexabromocyclododecane			b	b															**2**
gamma-Hexabromocyclododecane			b		b														**2**
Hexachlorobenzene (HCB)	oth*		b	b	w	b, s	b	s	w, b, s			w, b, s		w	w, b, s	w, s	b, s, oth*		**13**
Hexachlorobutadiene (HCBD)			w, b				b		w, b, s			w, b, s		w	b		s		**7**
Hexachlorocyclohexane (ΣHCH: Σα-, β-, δ-, ε- ,γ-HCH)			w											w					**2**
HCH (α-, β-, γ-HCH)	oth*				b, s				w, s										**3**
Alpha-HCH			w	b		b, s						w, b, s			w, b, s		s		**6**
Beta-HCH			w	b								w, b, s			w, b, s		s		**5**
Gamma-HCH (Lindane)				b		b, s		b, s				w, b, s			w, b, s	w, s	s		**7**
Delta-HCH			w												w				**2**
Heptachlor			b				b		b, s			w, b, s		w	b	w, s			**7**
Heptachlor epoxide			b						b, s			w, b, s		w	b				**5**
Hexazinone			w																**1**
Imidacloprid			w											w					**2**
Isoproturon			w		w, b, s				w			w, s		w	w		s		**7**
Linuron			w																**1**
MCPA			w				w			w				w					**4**
Mecoprop			w							w				w					**3**
Metazachlor			w																**1**
Methabenzthiazuron			w																**1**
Metolachlor			w																**1**
Metribuzin			w																**1**
Mevinphos														w					**2**
Mineral oil index															w				**1**
Mirex												b, s							**1**
Monolinuron			w																**1**
Mustard Gas (Sulfur Mustard/Yperite) and its derivatives															s				**1**
Nonylphenol			w	s	w, b, s	s	w		w			w, s		w	w		s		**10**
Octylphenol			w	s	w, b, s	s			w			w, s		w	w		s		**9**
Omethoate			w																**1**
Parathion			w																**1**

Elements	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI	TOTAL MS
Parathion-methyl			w																**1**
Total PAHs (Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(ghi)perylene, Indeno(1,2,3-cd)pyrene)		b, s			b, s		b, s			s						w, s	b		**6**
ΣPAH9: anthracene; benzo[a]anthracene; benzo[ghi]perylene; benzo[a]pyrene; chrysene; fluoranthene; indeno[1,2,3-cd]pyrene; pyrene; phenanthrene	b, s			b						b						w, s	b		**5**
Anthracene			w, b, s	b, s	b, s	b, s		b, s	s	w		w, s		w, b, s	w	w, s	b, s		**12**
Acenaphthene				b, s												w, s	b, s		**3**
Acenaphtylene				b, s												w, s	s		**3**
Benz(a)anthracene			b, s	b, s		b, s		b, s		w		w, s		w, b, s		w, s	b, s		**9**
Benzo(a)pyrene		b, s	b, s	b, s		b, s		b, s	b, s	w		w, b, s	s	w, b, s	w, b, s	w, s	b, s		**13**
Benzo(b)fluoranthene			b	b, s		b, s		b, s		w		w, s		w	w, b, s	w, s	b, s		**10**
Benzo(g,h,i)perylene			b, s	b, s		b, s		b, s		w		w, s	s	w, b, s	w, b, s	w, s	b, s		**11**
Benzo(k)fluoranthene			b	b, s		b, s		b		w		w, s	s	w	w, b, s	w, s	b, s		**11**
Indeno(1,2,3,-cd)pyrene			b, s	b, s		b, s		b, s		w		s		b, s	b, s	w, s	b, s		**10**
Benzo[e]pyrene				b, s															**1**
Chrysene				b, s		b, s						w, s		w, b, s		w, s	b, s		**6**
Dibenzo(a,h)anthracene				b, s		b, s				w						w, s	b, s		**5**
Dibenzothiophene				b, s															**1**
Fluoranthene			w, b, s	b, s	b, s	b, s		b, s	b, s	w		w, b, s		w, b, s	w, b, s	w, s	b, s		**12**
Fluorene				b, s												w, s	b, s		**3**
Naphthalene			b, s	b, s	b, s			b, s		w		w, s		w	w	w, s	b, s		**10**
Perylene				b, s															**1**
Phenanthrene			w, b, s	b		b, s		b, s				s		w, b, s		w, s	b, s		**8**
Pyrene			b, s	b, s		b, s		b, s		w		w, s		b, s		w, s	b, s		**9**
1-Hydroxypyrene			b												b				**2**
1-Hydroxyphenanthrene															b				**1**
4-Methylphenanthrene				s															**1**
PBDEs (congener numbers 28, 47, 99, 100, 153, 154)	b, s		w, b, s	b			w, b, oth**			w, s		w, b, s	b, s	w, b, s	w, b				**9**
PBDEs (congener numbers 28, 47, 66, 85, 99, 100, 153, 154, and 183)					b, s	b, s			w, b, s								s		**4**
BDE 66			w, s	b															**2**
BDE 85			w, s	b															**2**
Bis(pentabromophenyl) ether			w														s		**2**
Hexabromodiphenylether												b							**1**
Pentachlorobenzene			w		w, b				w, s			b, s		w	w		s		**7**
Pentachlorophenol			w		w, b, s				w, s			w, s		w	w		s		**7**

Elements	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI	TOTAL MS
Perfluorooctane sulfonic acid (PFOS) and its derivatives			w, b	b	w, b, s		w, b, s		b, s	w, b, s		w, b, s	b, s	w	b		b, s, oth*		**11**
Perfluorodecane sulfonate (anion)+ (PFDS)																	b, s, oth*		**1**
Perfluorodecanoate (PFDA)				b													b, s, oth*		**2**
Perfluorododecanoate (PFDoDA)																	b, s, oth*		**1**
Perfluorohexane sulfonate (PFHxS)				b													b, s, oth*		**2**
Perfluorohexanoate (PFHxA)																	b, s, oth*		**1**
Perfluoroheptanoate (PFHpA)																	b, s, oth*		**1**
Perfluorononanoate (PFNA)				b													b, s, oth*		**2**
PFOA			w	b			w			w							b, s, oth*		**5**
Perfluorooctane sulfonamide (FOSA)				b													b, s, oth*		**2**
Perfluoropentadecanoate (PFPeDA)																	b, s, oth*		**1**
Perfluorotetradecanoate (PFTeDA)																	b, s, oth*		**1**
Perfluorotridecanoate (PFTrDA)																	b, s, oth*		**1**
Perfluoroundecanoate (PFUnDA)				b													b, s, oth*		**2**
Petroleum hydrocarbons					w, s							w, s				w, s			**3**
Phenol					w, b, s														**1**
Phoxim			w																**1**
Picolinafen			w																**1**
Pirimicarb			w																**1**
Polychlorinated dibenzo-p-dioxins (PCDDs), Polychlorinated dibenzofurans (PCDFs)			b	b, s			oth**										s		**4**
Polychlorinated dibenzodioxins (PCDD)										b		b, s							**2**
Polychlorinated dibenzofurans (10 PCDFs)										b		s							**2**
Dioxins and dioxin-like compounds (7 PCDDs + 10 PCDFs + 12 PCB-DLs)	b, s				b		b	b	b, s	b		w, b, s		w	b		b, s, oth*		**10**
Non-dioxin like PCB (sum of 6 PCB: 28, 52, 101, 138, 153 and 180)					b											w, s	b, oth*		**3**
Polychlorinated biphenyls (7 PCB: 28,52,101,118,138,153,180)						b, s	b		b, s	b, s					b, s				**5**
Polychlorinated biphenyls (incl. 62 PCB congeners)	oth*																		**1**
PCB 28			b, s	b		b, s		b, s						b, s			s		**6**
PCB 52			b, s	b		b, s		b, s						b, s			s		**6**
PCB 77				b, s													s		**2**
PCB 81				b, s													s		**2**
PCB 101			w, b, s	b		b, s		b, s						b, s			s		**6**
PCB 105			b	b, s		b, s											s		**4**
PCB 114				b, s													s		**2**
PCB 118			b, s	b, s		b, s		b, s						b, s		w, s	s		**7**
PCB 123			b	b, s													s		**3**

Elements	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI	TOTAL MS
PCB 126				b, s													s		**2**
PCB 138			b, s	b		b, s		b, s						b, s			s		**6**
PCB 149				b															**1**
PCB 151				b															**1**
PCB 153			w, b, s	b		b, s		b, s						b, s			s		**6**
PCB 156			b	b, s		b, s											s		**4**
PCB 157				b, s													s		**2**
PCB 167				b, s													s		**2**
PCB 169				b, s													s		**2**
PCB 170				b															**1**
PCB 180			b, s	b		b, s		b, s						b, s			s		**6**
PCB 187				b															**1**
PCB 189				b, s													s		**2**
Prometryn			w																**1**
Propiconazole			w																**1**
Quinoxyfen			w						w, s			w, s		w					**4**
Resorcinol					w, b, s														**1**
Silicon																	s		**1**
Simazine			w		w, b, s				w			w, s		w	w		s		**7**
Sulcotrione			w																**1**
Sulfur																	s		**1**
Terbuthylazine			w											w					**2**
Terbutryn			w						w			w, s		w					**4**
Tetrachloroethylene			w									w, s		w	w		s		**5**
Toluene					w												s		**2**
Total cyclodiene pesticides (aldrin + dieldrin + endrin + isodrin)					w, b, s									w	w				**3**
Aldrin			w			b, s			w			w, b, s				w, s			**5**
Dieldrin			w			b, s		b	w			w, b, s				w, s			**6**
Endrin			w			b, s			w			w, b, s				w, s			**5**
Isodrin			w			b, s			w			w, b, s							**4**
Total oil							oth***												**1**
Toxaphene												b, s							**1**
Triazophos														w					**1**
Dibutyltin				b, s		s							s	w, s			b, s		**5**
Dioctyltin													s				b, s		**2**
Diphenyltin-cation (DPhT)																	b, s		**1**
Monobutyltin ion				s		s								s			b, s		**4**

Elements	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI	TOTAL MS
Monooctyltin-cation (MOT)																	b, s		**1**
Tetrabutyltin													s				b		**2**
Tributyltin compounds	b, s	b		b, s			w, s	b	w, b, s	w, s		w	b, s	w, s	w, b		b		**12**
Tributyltin-cation			s	b, s	w, b, s	s						s		w	s		b, s		**8**
Monophenyltin-cation (MPhT)																	b, s		**1**
Triphenyltin and compounds			s	b, s										w			b, s		**4**
Trichlorobenzene			w		w, s				w			w, s		w	w				**6**
Trichloroethylene			w						w			w, s		w	w		s		**6**
Trichloromethane			w		w				w			w, s		w	w		s		**7**
Tricyclohexyltin-cation (TCHxT)																	b		**1**
Trifluralin			w		w, b, s				w			w, s		w	w		s		**7**
Xylene														w					**1**
Meta xylene																	s		**1**
Meta xylene + para xylene					w														**1**
o-Xylene					w														**1**
Radionuclides																			
Ac-228																	w, b, s		**1**
Ag108																	w, b, s		**1**
Ag-110m	w, b, s																w, b, s		**2**
Am-241																	w, b, s		**1**
Ba-140																	w, b, s		**1**
Be-7	w, b, s																w, b, s		**2**
Bi-214																	w, b, s		**1**
C-14																	w, b, s		**1**
Ce-141																	w, b, s		**1**
Ce-143																	w, b, s		**1**
Ce-144																	w, b, s		**1**
Co-57	w, b, s																w, b, s		**2**
Co-58	w, b, s																w, b, s		**2**
Co-60	w, b, s						w, b, s										w, b, s		**3**
Cr-51																	w, b, s		**1**
Cs-134			b																**1**
Cs-136																	w, b, s		**1**
Cs-137			w		w, b, s		w, b, s						w, s		w, b, oth[m],s		w, b, s		**6**
Cs-138																	w, b, s		**1**
Eu-152																	w, b, s		**1**
Eu-154																	w, b, s		**1**

Elements	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI	TOTAL MS
Fe-59																	w, b, s		**1**
H-3															w		w, b, s		**2**
K-40	w, b, s	b			w, b, s										w		w, b, s		**5**
Kr-85																	w, b, s		**1**
I-131	w, b, s																w, b, s		**2**
I-132																	w, b, s		**1**
I-133																	w, b, s		**1**
I-134																	w, b, s		**1**
I-135																	w, b, s		**1**
La-140																	w, b, s		**1**
Mn-54	w, b, s																w, b, s		**2**
Mo-99																	w, b, s		**1**
Na-22																	w, b, s		**1**
Na-24																	w, b, s		**1**
Nb-95																	w, b, s		**1**
Nb-97																	w, b, s		**1**
Np-239																	w, b, s		**1**
Pb-212		b, s															w, b, s		**2**
Pb-214																	w, b, s		**1**
Pu-238															s				**1**
Pu-239+240	w, b, s														s				**2**
Ra-223																	w, b, s		**1**
Ra-226	w, b, s																w, b, s		**2**
Rh-105																	w, b, s		**1**
Ru-103																	w, b, s		**1**
Ru-106																	w, b, s		**1**
Sb-122																	w, b, s		**1**
Sb-124																	w, b, s		**1**
Sb-125																	w, b, s		**1**
Sn-113																	w, b, s		**1**
Sr-90							w, b, s								w, s				**2**
Te-129m	w, b, s																w, b, s		**2**
Tl-208																	w, b, s		**1**
U-234	w, b, s																		**1**
U-235	w, b, s																		**1**
U-238	w, b, s																		**1**
Xe-131m																	w, b, s		**1**

Elements	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI	TOTAL MS
Xe-133																	w, b, s		**1**
Zn-65	w, b, s																w, b, s		**2**
Zr-95																	w, b, s		**1**
Zr-97																	w, b, s		**1**
TOTAL ELEMENTS (316)	**30**	**7**	**131**	**89**	**60**	**51**	**28**	**31**	**56**	**34**	**1**	**81**	**19**	**92**	**72**	**36**	**195**	**1**	

Table A10. Biological-effect methods (parameters) and species (elements) reported for D8C2.

Parameter	BE	DE	DK	EE	ES	FI	FR	HR	IE	IT	LV	NL	PL	SE	TOTAL MS
Method not specified ('ext' or 'other')								M. gallorpovincialis		all cont.					**2**
% oiled among stranded guillemots	Uria aalge														**1**
Acetylcholinesterase (AChE) activity					M. gallorprovincialis Mullus barbatus						Limecola balthica				**2**
EROD enzymatic activity			Zoarces viviparus		Mullus barbatus										**2**
Glutathione-S-Transferase (GST) Catalase (CAT) activity											Limecola balthica				**1**
Fish Disease Index		Limanda limanda Platichthys flesus													**1**
Growth larvae (length)					Paracentrotus lividus										**1**
Imposex/intersex		Littorina littorea	Littorina littorea		Nucella lapillus Tritia reticulata		Nucella lapillus		Nucella lapillus			Tritia reticulata		Tritia nitida Peringia ulvae	**7**
Lysosomal membrane stability						Clupea harengus Perca fluviatilis	Mytilus edulis								**2**
Reproductive disorders and malformations			Zoarces viviparus								Monoporeia affinis			Monoporeia affinis Pontoporeia femorata	**3**
Metallothioneins					M. gallorprovincialis										**1**
Micronucleus test - genotoxicity index													Clupea harengus		**1**
PAH metabolites			Zoarces viviparus				Limanda limanda Platichthys flesus								**2**
Productivity, Brood size, Breeding success				Haliaeetus albicilla									Haliaeetus albicilla	Haliaeetus albicilla	**3**
Externally visible fish diseases													Coastal fish Demersal fish		**1**

Visual inspection of external and internal defects/diseases															Perca fluviatilis Zoarces viviparus		**1**
TOTAL PARAMETERS (16)	**1**	**2**	**4**	**1**	**5**	**1**	**3**	**1**	**1**	**1**	**3**	**1**	**3**	**4**			

Table A11: Elements (contaminants) and parameters (matrix or species, when indicated) reported for D9. Contaminants regulated under Food Regulation 1881/2006 are highlighted in bold. b: concentrations in biota; b-LI: concentrations in liver: b-MU: concentrations in muscle; b-FA: concentrations in fat; oth: other.

Elements	**BE**	**CY**	**DE**	**DK**	**EE**	**ES**	**FI**	**FR**	**HR**	**IE**	**IT**	**LT**	**LV**	**NL**	**PL**	**RO**	**SE**	**SI**	**TOTAL MS**
All Contaminants								ratio			oth								**2**
Organochlorine pesticides														b b-LI b-MU					**1**
Arsenic and its compounds							*Perca fluviatilis* *Esox lucius* *Sprattus sprattus*							b b-MU					**2**
Cadmium	b	*Mullus sp.* *Boops boops*		oth	b	b-FA	*Perca fluviatilis* *Esox lucius* *Sprattus sprattus*	b	Mass fraction in biota	b		fish	Food products	b b-MU	Fish liver: herring, perch and flounder	Mytilus sp.		oth	**15**
Lead	b	*Mullus sp.* *Boops boops*		oth	b	b-FA	*Perca fluviatilis* *Esox lucius* *Sprattus sprattus*	b	Mass fraction in biota	b		fish	Food products	b b-MU	Fish liver: herring, perch and flounder	Mytilus sp.		oth	**15**
Mercury	b	*Mullus sp.* *Boops boops*		oth	b	b-FA	*Perca fluviatilis* *Esox lucius* *Sprattus sprattus*	b	Mass fraction in biota	b		fish	Food products	b b-MU	Fish liver: herring, perch and			oth	**14**

Elements	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI	TOTAL MS
															flounder				
Hexabromocyclododecanes (HBCDD)														b-LI	Fish muscle: herring, perch and flounder				**2**
Sum 4PAH (benzo(a)pyrene, benz(a)anthracene, benzo(b)fluoranthene and chrysene)	b																		**1**
Sum of PAHs (Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene)		*Mullus sp. Boops boops*		oth				b	Mass fraction in biota	b				b					**6**
Benzo(a)pyrene	b					b-FA		b	Mass fraction in biota	b						Mytilus sp.			**6**
PBDEs (congener numbers 28, 47, 99, 100, 153, 154)							*Perca fluviatilis Esox lucius Sprattus sprattus*								Fish muscle: herring, perch and flounder				**2**
PBDEs (congener numbers 28, 47, 66, 85, 99, 100, 153, 154, and 183)														b b-LI b-MU					**1**
Per- and polyfluoroalkyl substances														b b-LI b-MU					**1**

Elements	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI	TOTAL MS
Perfluorooctane sulfonic acid (PFOS) and its derivatives							*Perca fluviatilis Esox lucius Sprattus sprattus*								Fish muscle: herring, perch and flounder				**2**
Dioxin-like polychlorinated biphenyls (12 PCB-DLs: 77,81,105,114,118,123,126,156,157,167,169,189)	b			oth			*Perca fluviatilis Esox lucius Sprattus sprattus*							b b-LI b-MU			b-total (Mytilus edulis) b-MU (Clupea harengus, Perca fluviatilis)		**5**
Dioxins and dioxin-like compounds (7 PCDDs + 10 PCDFs + 12 PCB-DLs)* or (7 PCDDs + 10 PCDFs + 6 PCB-DLs)**	*b				*b			*b	*Mass fraction in biota	*b		**fish	*,**Clupea harengus Sprattus sprattus		**Fish liver: herring, perch and flounder		*b-total (Mytilus edulis) *b-MU (Perca fluviatilis)	*oth	**10**
Non-dioxin like PCB (sum of 6 PCB: 28, 52, 101, 138, 153 and 180)	b	*Mullus sp. Boops boops*		oth	b	b-FA		b	Mass fraction in biota	b		fish	Clupea harengus Sprattus sprattus	b b-LI b-MU	Fish muscle: herring, perch and flounder	Mytilus sp.	b-total (Mytilus edulis) b-MU (Perca fluviatilis, (Clupea		**14**

Elements	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI	TOTAL MS
																	haren gus)		
Sum of dioxins (WHO-PCDD/F-TEQ) or Total dioxins and furans (PCDD + PCDF)	b			oth	b	b-FA	*Perca fluviatilis Esox lucius Sprattus sprattus*	b	Mass fraction in biota	b		fish		b b-LI b-MU			b-total (Mytilus edulis) b-MU (Perca fluviatilis, (Clupea haren gus)	oth	**12**
Tributyltin-cation														b-LI	Fish muscle: herring, perch and flounder				**2**
TOTAL ELEMENTS (20)	**9**	**5**	**0**	**7**	**6**	**6**	**8**	**9**	**8**	**8**	**1**	**6**	**5**	**13**	**9**	**4**	**4**	**5**	

Table A12. Elements (litter categories) and parameters (environmental compartments) reported for D10C1 (c: coastline; ws: surface layer of the water column; wc: water column; sb: seabed; oth: other; mass: mass). * = additional elements not defined under the GES Decision.

Elements	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
Artificial Polymer Materials			c, sb, ws	c, sb		c, sb, ws, wc, oth	c, sb	sb, ws	c, sb, ws	c, oth	c, sb, ws			c, sb, mass	c		c, sb	c, ws, oth
Rubber			c, sb, ws	c, sb		c, sb, ws, wc, oth	c, sb	c, sb	c, sb, ws	c, oth	c, sb, ws			c, sb	c		c, sb	c, ws, oth
Cloth/Textile			c, ws	c, sb		c, sb, ws, wc, oth	c, sb	c, sb	c, sb, ws	c, oth	c, sb, ws			c	c		c, sb	c, ws, oth

Elements	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
Paper/carboard			c, ws	c, sb		c, sb, ws, wc, oth	c, sb	c	c, sb, ws	c, oth	c, sb, ws			c	c		c, sb	c, ws, oth
Processed/worked wood			c, ws	c, sb		c, sb, ws, wc, oth	c, sb	c, ws	c, sb, ws	c, oth	c, sb, ws			c	c		c, sb	c, ws, oth
Metal			c, sb, ws	c, sb		c, sb, ws, wc, oth	c	c, sb, ws	c, sb, ws	c, oth	c, sb, ws			c, sb	c		c, sb	c, ws, oth
Glass/Ceramics			c, sb, ws	c, sb		c, sb, ws, wc, oth	c, sb	sb	c, sb, ws	c, oth	c, sb, ws			c, sb	c		c, sb	c, ws, oth
Chemicals			c, ws					ws	c, sb, ws	c	ws						c, sb	c, ws, oth
Undefined			sb				c, sb	sb, ws		c	sb, ws	c, sb			c		c, sb	
Food Waste				c			c, sb			c	ws						c, sb	
*Macrolitter (all)	sb	c			c, sb, oth					c, oth			c, oth					
*Litter in the environment	c							oth		c, oth						c, sb		
*Ceramics/pottery			c				c, sb	c		c				c				
*Glass								c										
*Medical waste			c				c, sb	c		c				c			c, sb	
*Sanitary waste			c	c, sb		c, sb, ws, wc, oth	c, sb	c		c				c			c, sb	
*Plastic/polystyrene								c										
*Other materials			sb	c, sb		c, sb, ws, wc, oth				c, oth	sb, ws			sb			c, sb	c, ws, oth
*Not Applicable							oth											
TOTAL	**2**	**1**	**25**	**19**	**3**	**45**	**24**	**22**	**24**	**26**	**27**	**2**	**2**	**16**	**8**	**2**	**26**	**27**

Table A13. Elements (litter categories) and parameters (environmental compartments) reported for D10C2 (c: coastline; ws: surface layer of the water column; sb: seabed; oth: other; MASS: mass).

Elements	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
Artificial Polymer Materials		c	sb, ws	ws, oth	oth	c, sb, ws, oth	sb, ws	ws, oth	c, ws		ws	c, sb, ws	sb, ws	sb, MASS	sb, ws		c, sb, ws	c, sb, ws
Other materials							sb, ws				ws						c, sb, ws	c, sb, ws, oth
TOTAL	**0**	**1**	**2**	**2**	**1**	**4**	**4**	**2**	**2**	**0**	**2**	**3**	**2**	**2**	**2**	**0**	**6**	**7**

Table A14. Elements (litter categories) and parameters (biota) reported for D10C3 (b: amount in biota; MASS: mass; oth: other). * = additional elements not defined under the Commission Decision 2017/848.

Elements	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
Artificial Polymer Materials			b	MASS, oth		MASS		b	oth		MASS			MASS				
Other materials			b	MASS, oth		MASS					MASS							
*Macrolitter (all)	b	MASS																
*Not Applicable																		MASS, oth
TOTAL	**1**	**1**	**2**	**4**	**0**	**2**	**0**	**1**	**1**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**2**

Table A15. Parameters reported for each feature listed within D11C1 and D11C2. Some parameters are not listed in the MSFD Guidance Document 17 (bd: number of bang days; sd: spatial distribution, pbd: pulse-block-days, tr: time range, sm: ship movements. The numbers 63/125/2000 are referred to the center of the 1/3 octave frequency band, as the three D11C2 Elements).

	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
D11C1																		
PresInputSound		DUR, LEV-N		DUR, LEV-N	OTH								DUR, LEV-N, OTH				DUR, LEV-N	
PresEnvSoundImpulsive	LEV-N		DUR, LEV-N, OTH	DUR, LEV-N		DUR, LEV-N, OTH	DUR, LEV-N	DUR	DUR	OTH (bd)	DUR, LEV-N	DUR, LEV-N	DUR, LEV-N, OTH (sd)	OTH (pbd)	DUR, LEV-N	LEV-N		DUR, LEV-N, OTH (sd)
ActivMilitary				DUR, LEV-N														
ActivResearch				DUR, LEV-N														
D11C2																		
PresInputSound		SPL		SPL	OTH													SPL, OTH (tr, sd)

	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
PresEnvSoundContinuous	SPL		SPL (63/125)	SPL (63/125/2000)		OTH, SPL (63/125)	SPL (63/125/2000)	SPL (63/125)	SPL (125)		SPL (63/125)	SPL	SPL, OTH (DUR, sd)	LEV-N (63/125/2000)	SPL (63/125/2000)	SPL	SPL (63/125/2000)	
ActivTranspShip																	OTH (sm)	
TOTAL	**2**	**3**	**4**	**3**	**2**	**5**	**3**	**2**	**2**	**1**	**3**	**3**	**6**	**2**	**3**	**2**	**4**	**6**

Table A16. Parameters reported for each of the D11 features listed by MS as 'not relevant' or 'null' category under 'GEScriteria' reporting field. If the feature was listed but no parameters were reported, the features listed by MS are marked with a cross. Specifications given for other parameters are indicated in brackets; however, most of them were not complete in the corresponding fielf of the electronic report.

Not Relevant/NA	EE	ES	FR	SE
PresInputSound	LEV-N, OTH (Number of disturbance days - Impulsive underwater)		SPL, EXT	
PresEnvSoundContinuous		x		
PresEnvSoundImpulsive		x		
ActivCultivAquaculMarine	OTH (Production (tonnes); Area; Nutrient load)			
ActivExtrLivingFishHarv	OTH (Catch; By-catch)			
ActivExtrLivingHunt	OTH (Number of individuals hunted by species (waterbird)			
ActivExtrLivingPlantHarv	OTH (Amount (kg); Area)	x		
ActivExtrNonLivingMinerals	OTH (Mining volume; Mining area; Area pressure index)			
ActivExtrNonLivingOilGas	OTH (Pipe length (area); Area pressure index)			
ActivExtrNonLivingWater	OTH (Volume)			
ActivMilitary	OTH (Number of explosions; Number of trainings; Training)			x
ActivProdEnerCables	OTH (Cable length (area); Area pressure index)			
ActivProdEnerRenew	OTH (Area; Area pressure index)			x
ActivResearch	OTH (Volume of costs on marine researches; Number of re)			x
ActivRestrucCoastDef	OTH (Length of defence structure; Coastline pressure in)			
ActivRestrucOffshStruc	OTH (Area of structure; Area pressure index)			
ActivRestrucSeabedMorph	OTH (Soil volume; Extent; Area pressure index)			
ActivTourismActiv	OTH (Number of vacationists; Number of visits; People's)			

Not Relevant/NA	EE	ES	FR	SE
ActivTourismInfras	OTH (Number of marinas per coastline; Length of beach)	x		
ActivTranspInfras	OTH (Area; Volume (goods and passengers); Number of loa)			x
ActivTranspShip	OTH (Number of ships (incl. number of ships complying w)			
ActivUrbIndWaste	OTH (Areas of dumping sites and volume of dumped materi)			
PresInputCont	OTH (Pollution load (tonnes/year) - Hg, Cd, Cu, Pb, Zn,)			
PresInputLitter	AMO-C, AMO-SB, AMO-WC, OTH (Amount in sediments; Litter type and material)			
PresInputNut	OTH (Pollution load (tonnes/year) - N, P, BHT5)			
PresEnvAcuPolluEvents		x		
PresEnvContNonUPBTs		x		
PresEnvContUPBTs		x		
PresEnvEutrophi		x		
PresEnvLitter		x		
PresEnvLitterMicro		x		
PresEnvLitterSpp		x		

Table A17: List of D1- marine mammals reported.

Marine mammals	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LV	NL	PL	RO	SE	SI
Baleen Whales						+		+		+	+						
Balaenoptera acutorostrata						+		+		+							
Balaenoptera borealis						+				+							
Balaenoptera edeni						+											
Balaenoptera musculus						+				+							
Balaenoptera physalus						+		+		+	+						
Eubalaena glacialis										+							
Megaptera novaeangliae						+				+							
Deep Diving																	
Globicephala melas						+		+		+							

Marine mammals	**BE**	**CY**	**DE**	**DK**	**EE**	**ES**	**FI**	**FR**	**HR**	**IE**	**IT**	**LV**	**NL**	**PL**	**RO**	**SE**	**SI**
Grampus griseus						+		+		+							
Hyperoodon ampullatus						+				+							
Kogia breviceps						+				+							
Kogia simus						+											
Mesoplodon bidens						+											
Mesoplodon densirostris						+											
Mesoplodon europaeus						+				+							
Mesoplodon mirus						+				+							
Physeter macrocephalus						+		+		+	+						
Ziphius cavirostris						+				+							
Small Toothed																	
Delphinapterus leucas										+							
Delphinus delphis						+		+		+					+		
Globicephala macrorhynchus						+											
Lagenorhynchus acutus						+				+							
Lagenorhynchus albirostris						+		+		+							
Orcinus orca						+				+							
Phocoena phocoena	+		+	+		+	+	+		+		+	+	+	+	+	
Pseudorca crassidens						+				+							
Stenella coeruleoalba						+		+	+	+	+						
Stenella frontalis						+											
Steno bredanensis						+											
Tursiops truncatus						+		+	+	+	+				+		+
Seals																	
Halichoerus grypus	+		+	+	+	+	+	+		+		+	+	+		+	
Monachus monachus		+				+											
Phoca vitulina	+		+	+		+		+		+		+	+	+		+	

Marine mammals	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LV	NL	PL	RO	SE	SI
Pusa hispida			+		+	+	+					+				+	

Table A18: List of D1- fish reported.

Fish	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
Coastal		+	+	+	+	+		+	+	+	+	+	+	+		+	+
Abramis brama		+	+	+		+										+	
Acipenser oxyrinchus		+															
Agonus cataphractus		+															
Aidablennius sphynx					+												
Alburnus alburnus		+		+												+	
Alosa fallax			+	+													
Ammodytes tobianus		+		+													
Anguilla anguilla		+	+	+					+				+			+	
Anthias anthias					+												
Aphia minuta		+															
Apogon imberbis					+												
Atherina presbyter		+															
Auxis rochei rochei					+												
Ballerus ballerus		+															
Barbus barbus		+															
Blennius ocellaris					+												
Blicca bjoerkna		+		+		+										+	
Bodianus scrofa					+												
Boops boops					+												
Bothus podas					+												
Carassius carassius				+		+											
Carassius gibelio				+													
Centrolabrus melanocercus					+												

Fish	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
Cetorhinus maximus									+								
Chelon labrosus		+	+		+								+				
Chromis chromis					+												
Ciliata mustela		+	+										+			+	
Cobitis taenia				+													
Coregonus maraena		+		+												+	
Coregonus widegreni				+													
Coris julis					+					+							
Ctenolabrus rupestris			+										+			+	
Cyprinus carpio		+		+													
Dasyatis pastinaca					+												
Dentex dentex					+												
Dicentrarchus labrax					+												
Diplodus cervinus					+												
Diplodus puntazzo					+					+							
Diplodus sargus					+			+		+							
Diplodus vulgaris					+			+		+							
Entelurus aequoreus		+															
Epinephelus aeneus					+												
Epinephelus costae					+												
Epinephelus marginatus					+			+		+							
Esox lucius		+	+	+		+										+	
Gadus morhua			+	+												+	
Gasterosteus aculeatus		+	+													+	
Gobio gobio				+													
Gobiosoma bosc		+															
Gobius cruentatus					+												
Gobius geniporus					+												

Fish	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
Gobius niger			+	+	+											+	
Gobius vittatus					+												
Gymnocephalus cernua		+		+		+										+	
Hippocampus guttulatus													+				
Hippocampus hippocampus		+											+				
Hyperoplus immaculatus		+															
Hyperoplus lanceolatus		+		+													
Labrus bergylta					+								+			+	
Labrus merula					+												
Labrus viridis					+												
Lampetra fluviatilis		+	+	+					+				+				
Lepadogaster lepadogaster					+												
Leuciscus aspius		+		+		+											
Leuciscus idus		+		+		+										+	
Leuciscus leuciscus				+													
Lichia amia					+												
Liparis montagui		+															
Liza aurata					+												
Liza ramada		+			+												
Lophius piscatorius					+												
Lota lota				+													
Misgurnus fossilis		+															
Mugil cephalus					+												
Mullus barbatus					+												
Mullus surmuletus					+												
Muraena helena					+												
Mycteroperca rubra					+												

Fish	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
Myliobatis Aquila					+												
Neogobius melanostomus		+	+	+												+	
Nerophis lumbriciformis													+				
Nerophis ophidion													+				
Oblada melanura					+					+							
Osmerus eperlanus		+	+	+												+	
Pagellus acarne					+												
Pagellus erythrinus					+												
Pagrus pagrus					+												
Parablennius gattorugine													+				
Parablennius incognitus					+												
Parablennius pilicornis					+												
Parablennius rouxi					+												
Parablennius tentacularis					+												
Petromyzon marinus			+						+								
Pholis gunnellus		+															
Phycis phycis					+												
Platichthys flesus		+	+	+							+	+	+	+		+	
Platichthys solemdali				+													
Pleuronectidae		+															
Pollachius pollachius			+										+				
Pomadasys incisus					+												
Pomatoschistus lozanoi		+															
Pomatoschistus microps		+															
Pomatoschistus minutus		+															
Pungitius pungitius		+															

Fish	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
Raja miraletus								+									
Raja undulata					+												
Rutilus rutilus		+	+	+		+										+	
Salmo salar		+	+								+		+				
Salmo trutta		+							+								
Salmo trutta fario		+															
Sander lucioperca		+	+	+		+										+	
Sarda sarda					+												
Sarpa salpa					+					+			+				
Scardinius erythrophthalmus		+		+												+	
Sciaena umbra					+					+							
Scomber scombrus					+												
Scophthalmus maximus [Psetta maxima]		+	+	+													
Scorpaena maderensis					+												
Scorpaena notata					+												
Scorpaena porcus					+			+		+							
Scorpaena scrofa					+			+					+				
Seriola dumerilii					+												
Serranus atricauda					+												
Serranus cabrilla					+					+							
Serranus scriba					+												
Silurus glanis		+															
Sparus aurata					+												
Sphyraena viridensis					+												
Spicara maena					+												
Spinachia spinachia		+	+										+				
Spondyliosoma cantharus					+												

Fish	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
Squalius cephalus				+													
Symphodus cinereus																	+
Symphodus mediterraneus					+												
Symphodus melops			+										+			+	
Symphodus ocellatus					+												
Symphodus roissali					+												
Symphodus rostratus					+												
Symphodus tinca					+					+							
Syngnathus acus		+	+										+			+	
Thalassoma pavo					+												
Tinca tinca		+		+		+										+	
Trachinus draco					+												
Trachinus radiatus					+												
Trachurus mediterraneus					+												
Tripterygion delaisi					+												
Tripterygion melanurum					+												
Tripterygion tripteronotum					+												
Vimba vimba		+		+													
Zeus faber					+												
Zoarces viviparus		+	+	+									+			+	
Deep Sea			+		+				+				+				
Chimaera monstrosa			+										+				
Dalatias licha					+												
Deania calcea									+								
Etmopterus princeps									+								
Etmopterus pusillus									+								
Etmopterus spinax			+						+								

Fish	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
Galeus melastomus									+								
Helicolenus dactylopterus			+						+								
Malacocephalus laevis													+				
Phycis blennoides			+						+								
Polyprion americanus													+				
Xiphias gladius			+														
Demersal Shelf	+	+	+	+	+	+	+	+	+				+	+	+	+	+
Acantholabrus palloni					+												
Acipenser sturio		+	+														
Amblyraja radiata		+	+										+			+	
Anarhichas lupus			+										+				
Anguilla anguilla			+										+			+	
Anthias anthias					+												
Argentina silus			+										+			+	
Argentina sphyraena			+		+								+				
Argentina spp.							+										
Arnoglossus imperialis					+								+				
Arnoglossus laterna		+	+		+								+				
Arnoglossus rueppelli					+		+										
Arnoglossus thori					+												
Blennius ocellaris					+		+						+				
Boops boops					+												
Brosme brosme			+										+				
Buglossidium luteum		+	+		+								+				
Callanthias ruber					+												
Callionymus lyra		+	+		+								+				
Callionymus maculatus		+	+		+		+						+				
Capros aper					+												

Fish	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
Centrophorus granulosus							+										
Cepola macrophthalma					+												
Chelidonichthys cuculus			+		+		+						+				
Chelidonichthys lastoviza					+												
Chelidonichthys Lucerna			+		+		+										
Chelidonichthys obscurus					+		+										
Chimaera monstrosa			+		+		+						+				
Chlorophthalmus agassizi					+												
Citharus linguatula					+		+										
Coelorinchus caelorhincus					+		+										
Conger conger			+		+		+						+				
Coris julis					+												
Coryphaenoides rupestris																+	
Cottus gobio				+													
Ctenolabrus rupestris													+				
Dalatias licha							+										
Dasyatis pastinaca		+											+				
Deltentosteus quadrimaculatus					+												
Dicentrarchus labrax		+	+										+			+	
Diplodus annularis					+												
Diplodus bellottii					+												
Diplodus vulgaris					+												
Dipturus batis		+	+				+						+				
Dipturus oxyrinchus							+						+				
Echiichthys vipera		+	+				+						+				

Fish	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
Enchelyopus cimbrius		+	+										+				
Epigonus constanciae					+												
Epinephelus caninus					+												
Etmopterus spinax			+		+		+						+				
Eutrigla gurnardus		+	+		+		+						+			+	
Gadiculus argenteus			+		+								+				
Gadus morhua		+	+				+						+	+		+	
Gaidropsarus biscayensis					+												
Gaidropsarus granti					+												
Gaidropsarus macrophthalmus			+		+								+				
Gaidropsarus vulgaris		+	+										+				
Galeorhinus galeus		+	+				+						+				
Galeus melastomus					+		+						+				
Glossanodon leioglossus					+		+										
Glyptocephalus cynoglossus			+										+			+	
Gobius niger					+												
Helicolenus dactylopterus		+	+		+		+						+				
Hippoglossus hippoglossus			+										+				
Hoplostethus mediterraneus					+												
Hymenocephalus italicus					+												
Labrus mixtus					+								+				
Lappanella fasciata					+												
Lepidopus caudatus					+		+										
Lepidorhombus boscii					+		+										
Lepidorhombus whiffiagonis					+												

Fish	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
Lepidotrigla cavillone					+												
Lepidotrigla spp.					+												
Lesueurigobius friesii					+												
Lesueurigobius sanzi					+												
Leucoraja circularis													+				
Leucoraja fullonica							+										
Leucoraja naevus					+		+										
Limanda limanda		+	+										+			+	
Liparis liparis		+	+														
Lophius budegassa	+				+		+						+				
Lophius piscatorius			+		+		+						+			+	
Lumpenus lampretaeformis		+	+										+				
Macroramphosus scolopax					+								+				
Melanogrammus aeglefinus		+	+										+			+	
Merlangius merlangus		+	+										+	+	+	+	+
Merluccius merluccius	+		+		+		+	+					+			+	
Microchirus azevia					+												
Microchirus boscanion					+												
Microchirus variegatus			+		+								+				
Micromesistius poutassou			+		+											+	
Microstomus kitt		+	+										+			+	
Molva dypterygia			+										+				
Molva macrophthalma					+		+										
Molva molva			+				+						+			+	
Mullus barbatus					+												
Mullus barbatus barbatus	+				+			+					+				
Mullus surmuletus		+	+		+			+					+				

Fish	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
Muraena helena					+												
Mustelus asterias		+	+										+				
Mustelus mustelus			+										+				
Mustelus spp.							+										
Myliobatis Aquila																	+
Myoxocephalus quadricornis			+	+									+				
Myoxocephalus Scorpius		+	+	+									+			+	
Nezumia aequalis					+												
Oxynotus centrina					+												
Pagellus acarne					+												
Pagellus bellotii					+												
Pagellus bogaraveo					+												
Pagellus erythrinus	+				+												
Pagrus pagrus					+								+				
Perca fluviatilis		+	+	+		+										+	
Peristedion cataphractum					+		+										
Petromyzon marinus		+	+										+				
Phycis blennoides			+		+		+						+			+	
Phycis phycis					+												
Platichthys flesus			+											+		+	
Pleuronectes platessa		+	+										+	+		+	
Pollachius pollachius			+				+						+			+	
Pollachius virens			+										+			+	
Polyprion americanus					+												
Pontinus kuhlii					+												
Raja asterias							+										+
Raja clavata	+	+	+		+		+						+			+	
Raja miraletus							+										

Fish	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
Raja montagui		+	+		+		+						+				
Raja polystigma	+						+										
Raja undulata							+										
Scophthalmus maximus			+				+									+	
Scophthalmus maximus [Psetta maxima]		+											+				
Scophthalmus rhombus		+	+										+			+	
Scorpaena elongate					+												
Scorpaena loppei					+												
Scorpaena notata					+		+										
Scorpaena scrofa					+		+										
Scyliorhinus canicula		+	+		+		+	+					+			+	
Scyliorhinus stellaris					+		+										
Serranus cabrilla					+												
Serranus hepatus					+												
Solea solea					+												
Solea solea (sin. vulgaris)			+													+	
Spicara maena					+												
Spondyliosoma cantharus					+								+				
Squalus acanthias		+	+				+		+				+		+		
Squalus blainville							+										
Symphurus nigrescens					+		+										
Synchiropus phaeton					+												
Syngnathus typhle													+			+	
Taurulus bubalis			+	+									+			+	
Torpedo marmorata					+								+				+
Trachinus draco		+	+		+		+						+				

Fish	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
Trachurus mediterraneus					+												
Trachurus trachurus		+	+		+											+	
Trachyrhynchus scabrous					+												
Trachyrincus scabrous							+										
Trigla lyra					+		+						+				
Trisopterus capelanus					+												
Trisopterus luscus		+	+		+								+				
Trisopterus minutus					+												+
Uranoscopus scaber					+												
Zeus faber			+		+		+						+				+
Zoarces viviparus			+														
Pelagic Shelf		+	+	+	+	+	+	+	+		+		+			+	
Alosa alosa		+											+				
Alosa fallax		+	+						+				+				
Belone belone		+	+	+													
Clupea harengus		+	+	+			+									+	
Coregonus albula				+													
Coregonus lavaretus				+		+											
Cyclopterus lumpus		+	+	+									+			+	
Dicentrarchus labrax			+													+	
Engraulis encrasicolus		+	+		+		+	+									
Galeorhinus galeus			+														
Isurus oxyrinchus					+												
Lamna nasus			+														
Micromesistius poutassou					+		+										
Mola mola					+												
Pagellus erythrinus								+					+				

Fish	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
Pelecus cultratus				+													
Prionace glauca					+												
Salmo salar			+	+					+		+		+			+	
Salmo trutta trutta		+	+	+		+					+					+	
Sarda sarda			+														
Sardina pilchardus		+	+		+			+									
Scomber colias					+												
Scomber scombrus		+	+		+		+									+	
Sprattus sprattus		+	+	+												+	
Squalus acanthias			+													+	
Thunnus alalunga			+		+		+										
Thunnus thynnus					+		+		+								
Trachurus mediterraneus					+												
Trachurus picturatus					+												
Trachurus trachurus					+		+										
Xiphias gladius					+		+										

Table A19: List of D1-cephalopods reported.

Cephalopods	CY	DE	ES	SI
Coastal Shelf	+	+	+	+
Alloteuthis spp.				+
Eledone cirrhosa		+	+	
Eledone moschata			+	+
Illex coindetii		+	+	+
Loligo forbesii		+	+	
Loligo vulgaris		+	+	+
Octopus vulgaris			+	
Sepia elegans				+

Cephalopods	CY	DE	ES	SI
Sepia officinalis	+		+	+
Todarodes sagittatus		+	+	
Todaropsis eblanae			+	
Deep Sea		+	+	
Sepia officinalis		+	+	
Sepia orbignyana		+	+	
Todarodes sagittatus			+	
Todaropsis eblanae		+	+	

Table A20: List of D1-seabirds reported.

Sea birds	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	SE	SI
Benthic Feeding		+	+	+	+	+			+	+	+	+	+	+	+	+
Aythya ferina		+	+	+		+			+					+	+	
Aythya fuligula		+	+	+		+			+					+	+	
Aythya marila		+	+	+		+			+					+	+	
Bucephala clangula		+	+	+		+			+		+			+	+	
Clangula hyemalis		+	+	+		+			+		+	+		+	+	
Gavia arctica									+	+		+				
Gavia stellata			+						+	+		+				
Melanitta fusca		+	+	+		+			+	+	+	+		+	+	
Melanitta nigra		+	+	+	+				+	+	+		+	+	+	
Melanitta spp.			+											+		
Mergus serrator			+							+						
Phalacrocorax aristotelis					+					+						+
Podiceps nigricollis									+	+						
Polysticta stelleri				+							+	+				
Somateria mollissima		+	+	+		+			+	+	+			+	+	
Grazing		+	+	+		+			+			+		+	+	

Sea birds	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	SE	SI
Anas acuta		+	+	+		+			+					+	+	
Anas clypeata		+	+	+		+								+	+	
Anas crecca			+	+		+			+					+	+	
Anas penelope		+	+	+		+								+	+	
Anas platyrhynchos		+	+	+		+			+					+	+	
Anas strepera			+						+					+	+	
Anser albifrons			+	+					+					+		
Anser anser		+	+	+		+			+					+	+	
Anser brachyrhynchus									+							
Anser erythropus									+							
Anser fabalis									+							
Branta bernicla		+	+	+					+							
Branta canadensis			+	+		+			+						+	
Branta leucopsis			+	+		+			+					+	+	
Branta ruficollis									+							
Cygnus bewickii		+														
Cygnus columbianus			+	+					+			+		+		
Cygnus cygnus		+	+	+					+					+	+	
Cygnus olor		+	+	+		+			+					+	+	
Fulica atra		+	+	+		+			+					+	+	
Gallinula chloropus									+							
Mareca penelope									+							
Rallus aquaticus									+							
Spatula clypeata									+							
Spatula querquedula									+							
Pelagic Feeding		+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Alca torda		+	+	+	+	+	+		+			+		+	+	
Bulweria bulwerii					+				+							
Calonectris borealis					+											

Sea birds	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	SE	SI
Calonectris diomedea borealis									+	+						
Cepphus grylle		+	+	+		+			+					+	+	
Fratercula arctica		+			+		+		+				+			
Fulmarus glacialis			+													
Gavia arctica		+	+	+								+	+	+	+	
Gavia immer									+							
Gavia spp.			+		+						+			+		
Gavia stellata		+	+	+								+	+	+	+	
Mergellus albellus		+	+	+		+			+		+			+	+	
Mergus merganser		+	+	+		+			+		+	+		+	+	
Mergus serrator		+	+	+		+			+		+			+	+	
Morus bassanus		+	+		+		+		+				+			
Phalacrocorax aristotelis			+		+		+	+	+						+	
Phalacrocorax carbo		+	+	+		+	+		+				+	+	+	
Phalaropus fulicarius									+							
Podiceps auritus		+		+					+					+	+	
Podiceps cristatus		+	+	+		+			+		+	+	+	+	+	
Podiceps grisegena		+	+	+					+					+	+	
Pterodroma madeira					+											
Puffinus baroli					+				+							
Puffinus gravis					+				+							
Puffinus yelkouan					+					+						
Rissa tridactyla			+		+											
Sterna dougallii							+									
Tachybaptus ruficollis									+						+	
Uria aalge		+	+	+	+	+	+		+				+		+	
Uria aalge albionis					+											
Surface Feeding	+	+	+	+	+	+	+	+	+	+		+	+	+	+	

Sea birds	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	SE	SI
Alle alle									+							
Bulweria bulwerii					+											
Calonectris borealis					+											
Calonectris diomedea					+		+									
Calonectris diomedea diomedea								+								
Chlidonias niger			+	+	+				+							
Fulmarus glacialis		+	+				+		+				+			
Gelochelidon nilotica							+		+							
Haliaeetus albicilla				+		+			+					+	+	
Hydrobates pelagicus					+		+		+	+						
Hydrocoloeus minutus		+	+	+	+				+			+	+		+	
Hydroprogne caspia		+		+		+			+						+	
Larus argentatus		+	+	+		+	+		+			+	+	+		
Larus audouinii					+		+	+								
Larus canus		+	+	+		+	+		+			+	+	+	+	
Larus fuscus		+			+		+									
Larus fuscus graellsii		+		+					+							
Larus fuscus intermedius			+	+												
Larus genei					+		+									
Larus marinus		+	+	+	+	+	+		+			+	+	+	+	
Larus melanocephalus		+	+		+		+		+							
Larus michahellis							+									
Larus ridibundus	+	+		+		+	+		+					+	+	
Oceanites oceanicus									+							
Oceanodroma castro					+				+							
Oceanodroma leucorhoa					+				+							
Pandion haliaetus									+						+	
Pelagodroma marina					+											

Sea birds	**CY**	**DE**	**DK**	**EE**	**ES**	**FI**	**FR**	**HR**	**IE**	**IT**	**LT**	**LV**	**NL**	**PL**	**SE**	**SI**
Pterodroma feae					+											
Puffinus griseus					+				+							
Puffinus mauretanicus					+		+		+							
Puffinus puffinus					+		+		+							
Puffinus yelkouan					+		+	+								
Rissa tridactyla		+	+		+		+		+				+			
Stercorarius longicaudus					+				+							
Stercorarius parasiticus		+	+	+	+	+	+		+						+	
Stercorarius pomarinus		+			+				+							
Stercorarius skua		+	+		+		+		+				+			
Sterna albifrons				+	+		+								+	
Sterna dougallii							+		+							
Sterna hirundo		+	+	+	+	+	+		+				+		+	
Sterna paradisaea		+	+	+		+			+				+		+	
Sterna sandvicensis		+	+	+	+	+	+						+	+	+	
Sternula albifrons		+	+		+	+			+				+	+		
Uria lomvia									+							
Xema sabini					+				+							
Wading		+	+	+		+			+				+	+	+	
Actitis hypoleucos				+					+						+	
Anas crecca		+														
Anthus petrosus									+						+	
Ardea alba									+					+	+	
Ardea cinerea									+					+	+	
Arenaria interpres		+	+	+		+			+						+	
Calidris alba		+	+	+					+							
Calidris alpina		+	+	+		+			+					+	+	
Calidris canutus		+	+	+					+							

Sea birds	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	SE	SI
Calidris ferruginea				+					+							
Calidris maritima		+	+						+						+	
Calidris minuta				+					+							
Charadrius alexandrinus		+	+						+							
Charadrius hiaticula		+	+	+		+			+					+	+	
Egretta garzetta									+							
Gallinago gallinago									+							
Haematopus ostralegus		+	+	+		+			+					+	+	
Larus argentatus			+											+	+	
Larus canus			+										+	+	+	
Larus fuscus			+			+							+		+	
Larus glaucoides									+							
Larus hyperboreus									+							
Larus michahellis									+							
Larus ridibundus													+	+		
Limosa lapponica		+	+	+					+							
Limosa limosa		+							+							
Numenius arquata		+	+	+					+						+	
Numenius phaeopus		+		+					+							
Phalaropus lobatus									+							
Philomachus pugnax		+	+	+					+							
Platalea leucorodia		+	+						+							
Pluvialis apricaria		+	+	+					+							
Pluvialis squatarola		+	+	+					+							
Recurvirostra avosetta		+	+	+					+							
Tadorna tadorna		+	+	+		+			+					+	+	
Tringa erythropus		+							+							
Tringa glareola			+	+					+							
Tringa nebularia		+	+	+					+							

Sea birds	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	SE	SI
Tringa totanus		+	+	+					+						+	
Vanellus vanellus		+	+	+					+						+	

Table A21: List of the monitored D1C6 parameters per element. SE among the 'Other_parameters' (OTH) reported 'Ice thickness', which is not the list of the coded parameters of the MSFD Guidance Document 17.

Elements	BE	DE	EE	ES	FI	FR	HR	IT	LT	LV	NL	PL	RO	SE	SI
Coastal pelagic habitat			EXT, OTH	EXT, OTH, PP, SIZE-D	SIZE-D, ABU, SPP-C, BIOM				TEM	CELL-C, SPP-C, BIOM			BIOM	EXT, PP, SPP-C, CELL-C, BIOM, CONC-W, TRA, TURB, OXY, TID, VEL, SAL, WAV, TEM, CO2, OTH	OTH
Shelf pelagic habitat															
Variable salinity pelagic habitat									SAL						
Oceanic/beyond shelf pelagic habitat															
Diatoms & Dinoflagellates		ABU, ABU-REL, SPP-C													
Phytoplankton communities	SPP-C, BIOM	ABU, ABU-REL, SPP-C	SPP-C, ABU			BIOM, ABU-REL, ABU	ABU, BIOM, SPP-C	SPP-C, ABU, BIOM			BIOM, SPP-C	ABU BIOM, SPP-C, EXT			
Zooplankton communities	ABU, ABU-REL	ABU, ABU-REL, BIOM SPP-C						EXT, PP, SIZE-D, SPP-C, ABU, BIOM				ABU, BIOM, SPP-C		ABU, BIOM	
Zooplankton communities - gelatinous															

Table A22: Elements (trophic guilds) and parameters (matrix) reported for D4C1.

Elements	DK	EE	ES	FI	HR	IT	LT	PL	SE	SI
All trophic guilds		OTH								OTH
Apex predator	OTH	OTH	OTH			OTH			OTH	
Deposit-feeder	OTH	OTH	OTH	OTH					OTH	
Filter-feeder	OTH		OTH	OTH					OTH	
Fish community	OTH	OTH		OTH				OTH	OTH	
Plantivores	OTH		OTH						OTH	
Primary Producers	OTH	OTH		OTH	OTH	OTH	OTH		OTH	
Seabed substrate and morphology				OTH						
Secondary Producers	OTH	OTH	OTH	OTH	OTH				OTH	
Sub-apex demersal predators		OTH	OTH			OTH			OTH	
Sub-apex pelagic predators			OTH							

Table A23. Elements (trophic guilds) and parameters (matrix) reported for D4C2.

Elements	DK	EE	ES	FI	HR	IT	LT	SE	SI
All trophic guilds		ABU, BIOM							OTH
Apex predator	ABU, BIOM	ABU, OTH	ABU, BIOM, OTH			ABU, BIOM		ABU, OTH	
Deposit-feeder	ABU, BIOM	ABU, BIOM, OTH	ABU, BIOM, OTH	ABU, BIOM				ABU, BIOM	
Filter-feeder	ABU, BIOM		ABU, BIOM, OTH	ABU, BIOM				ABU, BIOM, OTH	
Fish community	ABU, BIOM	ABU, OTH		ABU			ABU	ABU, BIOM	
Plantivores	ABU, BIOM		ABU, BIOM, OTH		ABU, BIOM			ABU, BIOM	
Primary Producers	ABU, BIOM	ABU, BIOM, OTH		BIOM	ABU, BIOM	ABU, BIOM		ABU, BIOM, OTH	
Seabed substrate and morphology				ABU, BIOM					
Secondary Producers	ABU, BIOM	ABU, BIOM	ABU, BIOM, OTH	ABU, BIOM	ABU, BIOM			ABU, BIOM	
Sub-apex demersal predators		ABU, BIOM	ABU, BIOM, OTH			ABU, BIOM		ABU, BIOM	
Sub-apex pelagic predators			ABU, BIOM, OTH					ABU, BIOM	

Table A24. Elements (trophic guilds) and parameters (matrix) reported for D4C3.

Elements	DK	ES	FI	HR	LT	NL	PL	SE	SI
All trophic guilds									OTH
Apex predator	SIZE-D	OTH						OTH	
Deposit-feeder	SIZE-D	OTH	SIZE-D						
Filter-feeder	SIZE-D	OTH	SIZE-D						
Fish community	SIZE-D				SIZE-D		SIZE-D	SIZE-D	
Plantivores	SIZE-D	OTH		SIZE-D	SIZE-D				
Primary Producers	SIZE-D								
Secondary Producers		OTH	SIZE-D					OTH	

Elements	DK	ES	FI	HR	LT	NL	PL	SE	SI
Sub-apex demersal predators		OTH				SIZE-D		SIZE-D, OTH	
Sub-apex pelagic predators		OTH				SIZE-D			

Table A25. Elements (trophic guilds) and parameters (matrix) reported for D4C4.

Elements	DK	EE	ES	FI	HR	SE
Apex predator	PROD, PP	OTH	OTH			PROD, OTH
Deposit-feeder	PROD, PP		OTH			
Filter-feeder	PROD, PP		OTH			
Fish community	PROD, PP					
Not applicable				PROD		
Plantivores	PROD, PP		OTH			
Primary Producers	PROD, PP			PROD	PROD	PROD, PP
Secondary Producers	PROD, PP		OTH		PROD	
Sub-apex demersal predators			OTH			
Sub-apex pelagic predators			OTH			

Table A26: Elements and parameters reported for D6 Criteria.

Criteria	Element	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
D6C1	Not Applicable	EXT		EXT, HAB-STRUCT	EXT	EXT, OTH	EXT	EXT	EXT		EXT	EXT, OTH		EXT	EXT	EXT		EXT	EXT
	Seabed substrate and morphology																		
D6C2	Not Applicable	EXT			EXT	EXT, OTH	EXT	EXT	EXT		EXT	OTH	EXT	OTH	EXT, DIST-S	EXT		EXT	EXT
D6C3	Benthic habitats	EXT				EXT													
	Infralittoral coarse sediment																		
	Offshore circalittoral coarse sediment																		

Criteria	Element	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
	Posidonia beds (Posidonion oceanicae)		OTH				EXT			EXT		EXT, OTH							
	Circalittoral coarse sediment	OTH			EXT				EXT				EXT						EXT
	Circalittoral mixed sediment									EXT									
	Circalittoral mud											OTH							EXT
	Circalittoral rock and biogenic reef											EXT, OTH							
	Circalittoral sand									EXT					ABU, PRE, SPP-C				
	Infralittoral coarse sediment	EXT, OTH																EXT, OTH	
	Infralittoral mixed sediment																		
	Infralittoral mud											OTH			ABU, PRE, SPP-C			EXT, OTH	EXT
	Infralittoral rock and biogenic reef																		
	Infralittoral sand													DIST-S, EXT					
	Littoral sediment						EXT												EXT
	Offshore circalittoral coarse sediment														ABU, PRE, SPP-C				
	Offshore circalittoral mixed sediment																		
	Offshore circalittoral mud						EXT						EXT		ABU, PRE, SPP-C				
	Offshore circalittoral sand								EXT	EXT									
	Upper bathyal sediment																		

Criteria	Element	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
	[Zostera] beds in infralittoral sediments				EXT		EXT												EXT
	Cymodocea beds																		
	Littoral rock and biogenic reef																		EXT
	Mudflats and sandflats not covered by seawater at low tide						EXT												
	Offshore circalittoral coarse sediment	OTH			EXT		EXT		EXT						EXT				
	Offshore circalittoral mixed sediment									EXT			EXT						
	Offshore circalittoral mud																		
	Offshore circalittoral rock and biogenic																		
	Offshore circalittoral sand				EXT					EXT			EXT		EXT				
	Reefs														ABU,PRE SPP-C			EXT, OTH	
	Sandbanks which are slightly covered by seawater all the time																		
	Submerged or partially submerged sea caves																		
	Upper bathyal rock and biogenic reef								EXT										
	Upper bathyal sediment									EXT									
	Not Applicable							EXT											
	Abyssal								EXT										

Criteria	Element	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
	Lower bathyal rock and biogenic reef			OTH			EXT								ABU, PRE, SPP-C, EXT			EXT, OTH	
	Lower bathyal sediment								EXT										
	Coralligenous habitat											EXT, OTH							
	Maerl beds											EXT, OTH							
	Littoral sediment						EXT												EXT
D6C4	Benthic habitats					EXT					EXT								
	Infralittoral coarse sediment																		OTH
	Offshore circalittoral coarse sediment	OTH			EXT		EXT		EXT						ABU, PRE, SPP-C				
	Posidonia beds (Posidonion oceanicae)		EXT, OTH				EXT			EXT		EXT, OTH							
	Circalittoral coarse sediment					EXT					EXT				EXT				EXT, OTH
	Circalittoral mixed sediment				EXT					EXT									
	Circalittoral mud										EXT	OTH			EXT		EXT		EXT, OTH
	Circalittoral rock and biogenic reef						EXT					EXT, OTH							
	Circalittoral sand				EXT					EXT					EXT		EXT		
	Infralittoral coarse sediment										EXT							EXT, OTH	
	Infralittoral mixed sediment																		
	Infralittoral mud											OTH					EXT	EXT, OTH	EXT, OTH

Criteria	Element	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
	Infralittoral rock and biogenic reef																		
	Infralittoral sand																EXT		
	Littoral sediment																		
	Offshore circalittoral coarse sediment									EXT					EXT				
	Offshore circalittoral mixed sediment																		
	Offshore circalittoral mud									EXT					EXT		EXT		
	Offshore circalittoral sand														EXT				
	Upper bathyal sediment				EXT		EXT			EXT	EXT								
	[Zostera] beds in infralittoral sediments				EXT						EXT								EXT, OTH
	Cymodocea beds																		
	Littoral rock and biogenic reef						EXT												EXT, OTH
	Mudflats and sandflats not covered by seawater at low tide				EXT														
	Offshore circalittoral coarse sediment				EXT		EXT				EXT				EXT				
	Offshore circalittoral mixed sediment				EXT		EXT			EXT	EXT								
	Offshore circalittoral mud				EXT		EXT			EXT	EXT				EXT		EXT		
	Offshore circalittoral rock and biogenic						EXT				EXT								
	Offshore circalittoral sand																		
	Reefs				EXT		EXT			EXT					EXT			EXT, OTH	

Criteria	Element	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
	Sandbanks which are slightly covered by seawater all the time																		
	Submerged or partially submerged sea caves																		
	Upper bathyal rock and biogenic reef																		
	Upper bathyal sediment				EXT					EXT	EXT								
	Not Applicable							EXT											
	Abyssal										EXT								
	Lower bathyal rock and biogenic reef																		
	Lower bathyal sediment																		
	Coralligenous habitat											EXT, OTH							
	Maerl beds																		
	Littoral sediment						EXT												
	Submarine structures made by leaking gases				EXT														
	Lower bathyal rock and biogenic reef						EXT												
D6C5	Benthic habitats	EXT, OTH				EXT, OTH	OTH									OTH			OTH
	Infralittoral coarse sediment				EXT	OTH	EXT	EXT, OTH						OTH				EXT, OTH	
	Offshore circalittoral coarse sediment				EXT														
	Posidonia beds (Posidonion oceanicae)		OTH							EXT		EXT, OTH							
	Circalittoral coarse sediment				EXT	OTH	EXT	EXT, OTH										EXT, OTH	EXT

Criteria	Element	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
	Circalittoral mixed sediment							OTH		EXT				OTH					
	Circalittoral mud			OTH	EXT							OTH					OTH	EXT, OTH	EXT
	Circalittoral rock and biogenic reef							EXT, OTH				EXT, OTH							
	Circalittoral sand									EXT							OTH	EXT, OTH	
	Infralittoral coarse sediment																		
	Infralittoral mixed sediment						EXT, OTH			EXT									
	Infralittoral mud			OTH								EXT, OTH						EXT, OTH	EXT
	Infralittoral rock and biogenic reef																		
	Infralittoral sand	EXT, OTH															OTH		
	Littoral sediment						EXT												
	Offshore circalittoral coarse sediment	EXT, OTH																EXT, OTH	
	Offshore circalittoral mixed sediment									EXT									
	Offshore circalittoral mud																	EXT, OTH	
	Offshore circalittoral sand																		
	Upper bathyal sediment																		
	[Zostera] beds in infralittoral sediments				EXT						EXT								
	Cymodocea beds																		
	Littoral rock and biogenic reef																		EXT
	Mudflats and sandflats not covered				EXT														

Criteria	Element	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
	by seawater at low tide																		
	Offshore circalittoral coarse sediment	OTH			EXT		EXT											EXT, OTH	
	Offshore circalittoral mixed sediment							OTH											
	Offshore circalittoral mud																OTH		
	Offshore circalittoral rock and biogenic																		
	Offshore circalittoral sand							OTH											
	Reefs			OTH	EXT		EXT			EXT								EXT, OTH	
	Sandbanks which are slightly covered by seawater all the time																		
	Submerged or partially submerged sea caves																		
	Upper bathyal rock and biogenic reef																		
	Upper bathyal sediment																		
	Not Applicable							EXT											
	Abyssal																		
	Lower bathyal rock and biogenic reef						EXT												
	Lower bathyal sediment																		
	Coralligenous habitat											EXT, OTH							
	Maerl beds																		
	Littoral sediment				EXT		EXT												

Criteria	Element	BE	CY	DE	DK	EE	ES	FI	FR	HR	IE	IT	LT	LV	NL	PL	RO	SE	SI
	Submarine structures made by leaking gases																		
	Lower bathyal rock and biogenic reef						EXT												
	Baltic muddy bottoms of the aphotic zone													OTH					
	Benthic habitats - macrophyte communities																		
	Coastal Zone Sand														ABU, PRE, SPP-C				
	Dogger Bank Sand																		
	Frysian Front Sand																		
	Offshore Sand																		
	Oyster Banks Mud																		

Table A27. Features reported per D6 criteria.

Features	D6C1	D6C2	D6C3	D6C4	D6C5
ActivCultivAquaculMarine	x	x		x	x
ActivExtrNonLivingMinerals	x	x		x	x
ActivExtrNonLivingOilGas	x				
ActivProdEnerCables	x	x		x	x
ActivProdEnerNonRenew	x				
ActivProdEnerRenew	x	x		x	x
ActivRestrucCanalisation	x	x		x	x
ActivRestrucCoastDef	x	x		x	x
ActivRestrucLandClaim	x	x		x	x
ActivRestrucOffshStruc	x	x		x	x
ActivRestrucSeabedMorph	x	x		x	x
ActivTourismActiv	x	x		x	x
ActivTourismInfras	x	x		x	x
ActivTranspInfras	x	x		x	x
ActivTranspLand	x	x		x	x
ActivTranspShip	x	x		x	x
ActivUrbIndIndustrial	x	x		x	x
ActivUrbIndUrban	x	x		x	x
ActivUrbIndWaste	x	x		x	x
CharaPhyHydro	x	x			
HabBenBHT			x	x	x
HabBenOther			x	x	x
PresBioExtractSpp		x			
PresPhyDisturbSeabed		x			
PresPhyLoss	x				
PrevEnvAdvEffectsSppHab					x

Table A28. Elements reported for D6 criteria.

D6 Elements per GES criteria	D6C1	D6C2	D6C3	D6C4	D6C5
[Zostera] beds in infralittoral sediments			X	X	X
Abyssal			X	X	
Baltic muddy bottoms of the aphotic zone					X
Benthic habitats			X	X	X
Benthic habitats - macrophyte communities					X
Circalittoral coarse sediment			X	X	X
Circalittoral mixed sediment			X	X	X

D6 Elements per GES criteria	D6C1	D6C2	D6C3	D6C4	D6C5
Circalittoral mud			X	X	X
Circalittoral rock and biogenic reef			X	X	X
Circalittoral sand			X	X	X
Coastal Zone Sand (NL)					X
Coralligenous habitat			X	X	X
Cymodocea beds			X	X	X
Dogger Bank Sand (NL)					X
Frysian Front Sand (NL)					X
Infralittoral coarse sediment			X	X	X
Infralittoral mixed sediment			X	X	X
Infralittoral mud			X	X	X
Infralittoral rock and biogenic reef			X	X	X
Infralittoral sand			X	X	X
Littoral rock and biogenic reef			X	X	X
Littoral sediment			X	X	X
Lower bathyal rock and biogenic reef			X	X	X
Lower bathyal sediment			X	X	
Maerl beds			X	X	X
Mudflats and sandflats not covered by seawater at low tide			X	X	X
Not Applicable	X	X	X	X	X
Offshore circalittoral coarse sediment			X	X	X
Offshore circalittoral mixed sediment			X	X	X
Offshore circalittoral mud			X	X	X
Offshore circalittoral rock and biogenic			X	X	X
Offshore circalittoral sand			X	X	X
Offshore Sand (NL)					X
Oyster Banks Mud (NL)					X
Posidonia beds (Posidonion oceanicae)			X	X	X
Reefs			X	X	X
Sandbanks which are slightly covered by seawater all the time			X	X	X
Seabed substrate and morphology	X	X			
Submarine structures made by leaking gases				X	X
Submerged or partially submerged sea caves			X	X	X
Upper bathyal rock and biogenic reef			X	X	X
Upper bathyal sediment			X	X	X

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13 **Acronyms**

ABU	Abundance (number of individuals)
ABU-REL	Relative abundance within community (of pelagic and benthic habitats)
AGE-D	Age distribution
ACCOBAMS	Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic area
AEWA	African-Eurasian Migratory Waterbird Agreement
ASCOBAMS	Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas
AMO-C	Amount on coastline
AMO-SB	Amount on seabed
AMO-WC	Amount in water column
BAL	Baltic Sea
BATH	Bathymetric depth
BC	Barcelona Convention
BC-001	UNEP/MAP Integrated Monitoring and Assessment Guidance (2016)
BC-IMAP	UNEP-MAP Integrated Monitoring and Assessment Programme
BIOM	Biomass
BLK	Black Sea
BON	Bonn Agreement
BON-001	Bonn Agreement Aerial Operations Handbook, 2009
BON-002	Bonn Agreement Aerial Operations Handbook, 2017
BON-003	Bonn Agreement Counter Pollution Manual (BACPM)
BREED	Breeding success
BSC	Black Sea Commission
CELL-C	Cell counts
CFP	Common Fisheries Policy
CFP-001	International bottom trawl survey in the Mediterranean Manual (Version 9)
CFP-002	Common protocol for the Pan-Mediterranean Acoustic Survey (MEDIAS) (v. 2017)
CFP-003	SISP 6 - Manual for mackerel and horse mackerel egg surveys, sampling at sea
CFP-004	SISP 15 - Manual of the IBTS North Eastern Atlantic Surveys
CFP-005	SISP 7 - BITS Manual for the Baltic International Trawl Surveys
CFP-006	SISP 8 - IBAS Manual for the International Baltic Acoustic Surveys
CFP-007	SISP 10 - Manual for the International Bottom Trawl Surveys, Revision IX
CFP-008	SISP 9 Manual for International Pelagic Surveys (IPS) - Version 1.00
CFP-009	Manual for the Offshore Beam Trawl Surveys (WGBEAM)
C-Hg	Minamata Convention on Mercury
CLRTAP	Convention on Long-Range Transboundary Air Pollution

CMS	Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)
CO2	pCO2 - alkalinity
COMBINE	HELCOM's Cooperative Monitoring in the Baltic Marine Environment
CONC-W	Concentration in water
CPH	Copenhagen Agreement
C-POP	Stockholm Convention on persistent organic pollutions (POPs)
CWS	Common Wadden Sea
CWS-001	Wadden Sea - Trilateral Monitoring and Assessment Programme Handbook
CWS-MAP	Trilateral Monitoring and Assessment Programme (TMAP)
DEP	Deposition
DIST-P	Distribution (pattern)
DIST-R	Distribution (range)
DIST-S	Distribution (spatial)
DUR	Duration
EC-002	Guidance on monitoring impulsive underwater noise
EC-003	Guidance on monitoring continuous underwater noise
EcoQO	Ecological Quality Objective
EEA	European Environment Agency
EMEP	European Monitoring and Evaluation Programme
EMI	Emission
E- PRTR	European Pollutant Release and Transfer Register
EU	European Union
EU-BD	Birds Directive
EU-BWD	Bathing Water Directive
EU-CFP-DCF	Data Collection Framework Multi-Annual Plan (CFP)
EU-EIA	Environmental Impact Assessment Directive (2011/92/EU)
EU-FSR	Foodstuffs Regulation
EU-HD	Habitats Directive
EU-IASR	Invasive Alien Species Regulation
EU-MSP	Maritime Spatial Planning Directive
EU-ND	Nitrates Directive
EU-NEC	National Emission Ceilings Directive
EU-Sev	Seveso Directive
EU-UWWD	Urban Waste Water Treatment Directive
EU-WaFD	Waste Framework Directive
EXT	Extent
F	Mortality rate
FEC	Fecundity (breeding rate)

FRE	Frequency
GES	Good Environmental Status
GFCM	General Fisheries Commission for the Mediterranean
HAB-STRUCT	Physical structure of habitat (e.g., sediment characteristics, topographic structure)
HELCOM	Baltic Marine Environment Protection Commission
HEL-001	HELCOM Guidelines for the annual and periodical compilation and reporting of waterborne pollution inputs to the Baltic Sea (PLC-Water)
HEL-002	HELCOM Guideline for the determination of heavy metals in sediment
HEL-003	HELCOM Guideline on the determination of perfluoroalkylated substances (PFAS) in seawater
HEL-005	HELCOM Guidelines for determination of chlorinated hydrocarbons in sediment
HEL-006	HELCOM Guidelines for determination of PAH in sediment
HEL-007	HELCOM Guidelines for determination of POPs in seawater
HEL-008	HELCOM Guidelines for determination of salinity and temperature using CTD
HEL-010	HELCOM Guidelines for measuring Secchi depth
HEL-011	HELCOM Guidelines for measuring turbidity
HEL-014	HELCOM Guidelines for monitoring of radioactive substances
HEL-016	HELCOM Guidelines for monitoring seal abundance and distribution in the HELCOM area
HEL-017	HELCOM Guidelines for monitoring reproductive status of seals in the HELCOM area
HEL-028	HELCOM Guidelines for coastal fish monitoring
HEL-029	HELCOM Guidelines for coordinated monitoring of wintering birds
HEL-031	HELCOM Manual on co-operation in response to marine pollution
HEL-032	HELCOM Manual for monitoring in COMBINE programme
HEL-034	HELCOM Guidelines for monitoring of biological effects - imposex and intersex
HEL-036	HELCOM Guidelines for monitoring continuous noise
HEL-MON	HELCOM Monitoring programmes
ICCAT	International Commission for the Conservation of Atlantic Tunas
ICC-001	ICCAT Manual: Data for Assessment and Research
ICES	International Council for the Exploration of the Sea
IMO-BWM	International Convention for the Control and Management of Ships' Ballast Water and Sediments
IMO-OPRC	International Convention on Oil Pollution Preparedness, Response and Co-operation
IMO-OPRC-HNS	Protocol on Preparedness, Response and Co-operation to pollution Incidents by Hazardous and Noxious Substances
INC	Incidence
LEN	Length
LEV-N	Level of sound
MAD	Adriatic Sea
MARPOL	International Convention for the Prevention of Pollution from Ships

MASS	Mass
MED	Mediterranean Sea
MEDIAS	Common protocol for the Pan-Mediterranean Acoustic Survey
MIC	Ionian Sea and Central Mediterranean Sea
MOR	Mortality (weight/volume; number of individuals)
MRU	Marine Reporting Unit
MS	Member States
MSFD	Marine Strategy Framework Directive
MWE	Western Mediterranean Sea
NEA	North-East Atlantic
NFC	North East Atlantic Fisheries Commission
NFC-001	NEAFC: Recording of Catch and Fishing Effort
NFC-002	NEAFC: Vessel Monitoring System
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
OSP-001	OSPAR Guidelines on Quality Assurance for Biological Monitoring in the OSPAR Area (Agreement 2002-15)
OSP-002	OSPAR CEMP Guideline: Common Indicator - Marine Bird Abundance (B1) (Agreement 2016-09)
OSP-003	OSPAR CEMP Guideline: Common Indicator - Marine Bird Breeding Success/Failure (B3) (Agreement 2016-10)
OSP-004	OSPAR CEMP Guideline: Common Indicator - Seal Abundance and Distribution (M3) (Agreement 2016-11)
OSP-005	OSPAR CEMP Guideline: Common Indicator - Grey Seal Pup Production (M5) (Agreement 2016-12)
OSP-008	OSPAR CEMP Guideline: Combined guideline for the common indicators FC1, FC2, FC3 and FW3 for fish and food webs (Agreement 2018-05)
OSP-011	OSPAR CEMP Guideline: Common indicator: Abundance at the relevant temporal scale of cetacean species regularly present (M4) – Interim version (Agreement 2018-09)
OSP-015	OSPAR CEMP Guidelines on Litter on the Seafloor
OSP-016	OSPAR CEMP Guidelines for Monitoring and Assessment of loud, low and mid-frequency impulsive sound sources in the OSPAR Maritime Region
OSP-018	OSPAR CEMP Guidelines for Monitoring Contaminants in Sediments (Agreement 2002-16)
OSP-020	OSPAR Revised JAMP Eutrophication Monitoring Guideline: Oxygen (Agreement 2013-05)
OSP-021	OSPAR Revised JAMP Eutrophication Monitoring Guideline: Nutrients (Agreement 2013-04)
OSP-022	OSPAR JAMP Eutrophication Monitoring Guidelines: Chlorophyll a in Water (Agreement 2012-11)
OSP-025	OSPAR JAMP Guidelines for General Biological Effects Monitoring. Revised technical annexes 2007 (Agreement 2007-07)
OSP-026	OSPAR JAMP Guidelines for Contaminant-Specific Biological Effects (Agreement 2008-09)
OSP-028	CEMP Guidelines for Monitoring Contaminants in Biota (Agreement 1999-02)
OSP-029	OSPAR CEMP guidelines for coordinated monitoring for eutrophication, CAMP and RID (Agreement 2016-05)

OSP-CEMP	OSPAR Coordinated Environmental Monitoring Programme
OTH	Other
OXY	Oxygen debt
PH	Ph
PRE	Presence
PROD	Productivity
PP	Primary production
RSC	Regional Sea Conventions
SAL	Salinity
SEX-D	Sex distribution
SIZE-D	Size distribution
SPL	Underwater sound level
SPP-C	Species composition
SUR	Survival rate
TEM	Temperature
TG Litter	Technical Expert Group on marine litter under the MSFD Common implementation strategy
TG Noise	Technical Group on Underwater Noise under the MSFD Common implementation strategy
TID	Tidal range/level
TRA	Transparency of water
TURB	Transparency / turbidity of water column
UNECE	United Nations Economic Commission for Europe
UNEP/MAP	United Nations Environment Programme - Mediterranean Action Plan
VEL	Current velocity
WAV	Wave action
WFD	Water Framework Directive
WFD-007	WFD Guidance document n.° 7 - Monitoring under the Water Framework Directive
WFD-019	WFD Guidance document n.° 19 - Monitoring under the Water Framework Directive (surface water chemical monitoring)
WFD-025	WFD Guidance document n.° 25 - Chemical Monitoring of Sediment and Biota
WFD-032	WFD Guidance document n.° 32 - Biota Monitoring
WFD-033	WFD Guidance document n.° 33 - Analytical Methods for Biota Monitoring
XML	Extensible Mark-up Language (file types)

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