

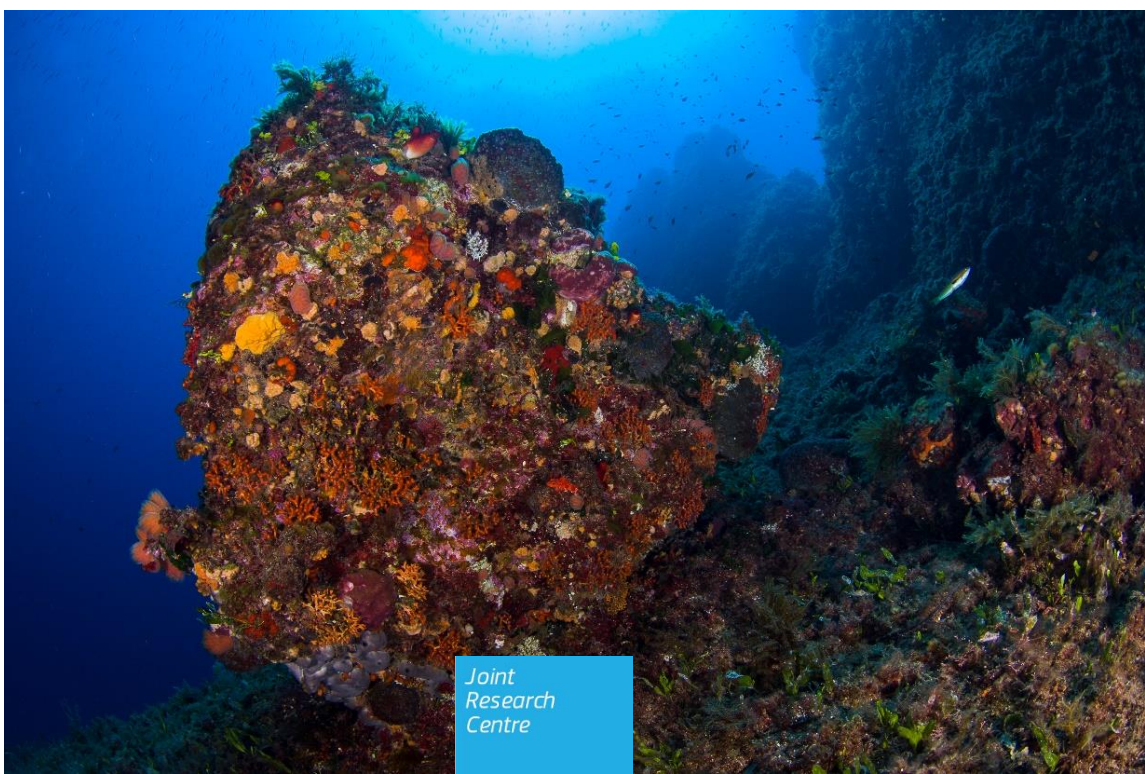
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In-depth assessment of the Member States' reporting for the Marine Strategy's biodiversity monitoring

*Support to the Member
States' monitoring
reporting*

Andreas Palialexis, Vasiliki Kousteni and
Francesca Somma

2019



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List of acronyms

CFP	common fisheries policy
DPSIR	drivers, pressures, state, impact and response
EEA	European Environment Agency
EU	European Union
GES	good environmental status
MS	Member State
MSFD	marine strategy framework directive
RSC	regional sea convention
WG DIKE	Data, Information and Knowledge Exchange Working Group
XML	Extensible Markup Language

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1. Introduction

Article 11 of the Marine Strategy Framework Directive (MSFD) obliges Member States (MSs) to monitor the environmental status of their marine waters. The Joint Research Centre (JRC) has performed an in-depth analysis on the MSs' reports for 2014. This analysis was focused on the biodiversity descriptor.

1.1. Scope of the work

This work aims to develop recommendations and propose emerging reporting requirements for the update of the monitoring programmes pursuant to Article 17 of the MSFD. Such recommendations will improve consistency, comparability and coherence in the monitoring and assessment of marine biodiversity. The results are tailored in accordance with the requirements of the new Commission Decision (2017/848/EU) (European Commission, 2017a) for criteria and methodological standards to determine good environmental status (GES). The application of the risk-based approach to European marine waters is among the emerging reporting requirements, as it was not sufficiently applied less in the first MSFD cycle.

The analysis goes deeper than the evaluation under Article 12 of the MSFD performed by the European Commission (European Commission, 2017b, c) after the MSs' reporting. Its scope goes beyond the evaluation of the individual MSs' performance and compliance, being focused on the technical assessment and evaluation of the reports at regional/sub-regional scales. The aim of this analysis is to provide the basis for an improved approach to monitoring of descriptor 1, but the conclusions are relevant to all MSFD descriptors.

2. Materials and methods

2.1. Sources of information

The main source of information was the 2014 MSs' reporting on monitoring pursuant to Article 11 of the MSFD. The MSFD Common Implementation Strategy Groups developed a guidance document to facilitate the MSs' reporting procedure (European Commission, 2014a). The reporting was structured around a number of questions that collectively provide a comprehensive view of the ongoing and planned monitoring programmes. The reporting format was organised in three sections:

- a) a general one, where the MSs provided general information in relation to the MSFD descriptors and their monitoring programmes;
- b) a monitoring programme section, where the MSs have organised their existing or new monitoring programmes according to the MSFD assessment elements (e.g. marine mammals, marine birds);
- c) a third section, where the monitoring programmes are split into subprogrammes providing detailed technical information organised in accordance with the reporting guidance document (European Commission, 2014a).

To this end, we compiled the information from the three databases and integrated it with the reporting information from other available sources (e.g. paper reports submitted by the MSs). The outcome was the basis for extracting, analysing and quantifying the reported information.

Data were retrieved from the European Environment Information and Observation Network Central Data Repository (Eionet CDR), which is the MSFD's official reporting platform.

The electronic reporting was made with the use of Extensible Markup Language (XML) files as the means to introduce information to the monitoring databases. The generation of XML files requires the reported information be held in a structured database. There were three options for reporting applications, according to the European Commission (2014a):

- Option A. In the Web-form application developed for article 11 reporting, managed by the European Environment Agency (EEA), which automatically generates the XML and submits it to ReportNet (see DIKE 8_2013_05¹);
- Option B. In a web-based application (e.g. Content Management System), managed at Member State or Regional level, capable of exporting the information in the XML format;
- Option C. In a non-web-based application (e.g. database), managed at Member State or Regional level, capable of exporting the information in the XML format.

An additional option (Option D) was to use formats that do not allow the generation of standard XML files; this could include provision as PDF files or other electronic formats.

It was expected that many MSs would use Option A, especially those that did not have bespoke information management systems in place for MSFD implementation.

Option B has been discussed within the Working Group on Data, Information and Knowledge Exchange (WG DIKE) and encouraged by the Commission as part of a forward process to modernise reporting processes using decentralised systems (as the systems that hold the information are held by the competent authorities in the MSs or anyone mandated by them). The benefits of this option are listed by the European Commission (2014a).

¹https://circabc.europa.eu/sd/a/84faaec7-815b-4ae5-9082-5ca2df7514c6/DIKE-8_2013_05_Art11WebForms_Schemas.doc

Option C was expected to be used by those MSs that maintain internal data management systems for policy delivery (and have not yet developed web-based systems — Option B — with similar purposes).

The final option, Option D, does not allow the generation of standard XML files. While the use of such formats may be helpful to prepare draft material (e.g. prior to its incorporation into any of the three database options above), it was not the Commission's preferred format for final transmission of the information. It usually had a different reporting structure and the information could not be directly integrated with other MSs' submissions and further analysed.

Twenty-three MSs have reporting obligations under the MSFD and all of them provided paper reports, in 15 languages. Only 11 MSs out of the 23 reported in a format suitable for transferring information to the database.

Details on the technical preparation of the reports, including use of the web-form application for reporting and preparation of XML schemas can be sought on the EEA ReportNet resource page (<http://icm.eionet.europa.eu/schemas/dir200856ec/resources2014>).

2.2. Screening and assessment of the reported information

The compilation of the reporting information was made by combining the database generated from the XML files and the paper reports, for those MSs that did not provide XML. Using common keys, we merged several tables of the database to encompass most of the required information, which was considered critical for the technical assessment of the monitoring information. The selection and prioritisation of the analysed information was based on the questions of the monitoring guidelines for the web-forms (European Commission, 2014a). We eventually generated three tables: a general one, one for the monitoring programmes and one for the monitoring sub-programmes. The extraction of the analogous information from the paper reports completed the reported information in the three tables. In many cases, the information reported in XML files was cross-checked with the paper reports, where available, because of the inconsistencies and lack of clarity that were noticed in the web-forms information.

2.3. Evaluation of the identified categories

The reporting sheet was to provide the information content in a standard format through a few relevant and agreed questions to the monitoring schemes (European Commission, 2014a). These questions were analysed to raise issues of general interest on the MSDF implementation and specific issues related to the biodiversity descriptors. Good practices and standardised or harmonised methods across the MSs were sought from the compiled reporting information. Moreover, technical monitoring gaps and reporting methodological deficiencies were identified.

The analysis followed two different approaches (Figure 1). The first one entailed three different dimensions:

- a) to identify good practices and lessons learnt for the monitoring process, to support the MS's preparation for the coming obligations by 2020;
- b) to identify good practices, in terms of monitoring approaches at regional or ecosystem-component level, that could be applied to other regions or other species and habitat groups;
- c) to consult on consistency and compliance with the MSFD requirements, aiming to improve the implementation in the second cycle.

The second approach referred to the perspectives applied in the analysis:

- a) the MSs' perspective, aiming to enhance potential joint monitoring efforts and adopt good practices from neighbouring states;

- b) the regional perspective, aiming to harmonise monitoring programmes, especially for highly mobile species with distributions beyond national waters;
- c) the European Commission’s perspective, aiming to identify gaps and drawbacks in the implementation, to facilitate the prioritisation of efforts in the preparation of the second MSFD cycle.

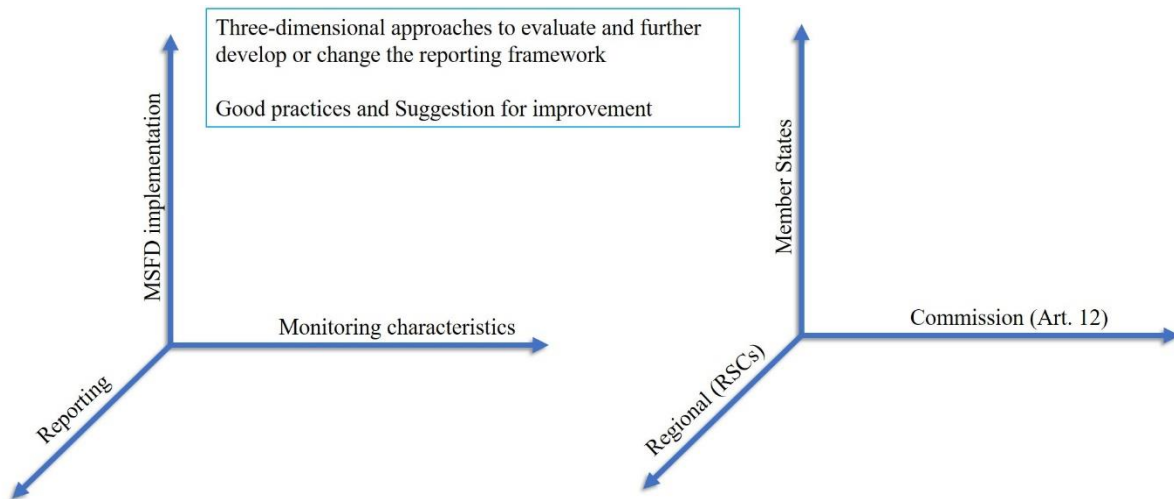


Figure 1. The two approaches followed to analyse the information reported for MSFD monitoring; each axis provides a unique perspective.

3. Results

The results follow the structure of the questions in the reporting sheet in the MSFD art. 11 guidance (European Commission, 2014a). The first part of the results refers to the general characteristics of the monitoring programmes, the second refers to the individual monitoring programmes and the third one is dedicated to the characteristics of the reported sub-programmes. Each question in the reporting sheet and the associated guidance is assessed based on MSs' reports. Suggestions for improvement are provided after each assessment.

A key issue in the reporting sheet is the definition of 'programme' and 'sub-programme'. A common understanding of these definitions is a prerequisite for consistent reporting across the MSs. Moreover, different understandings affect the level of detail reported in each section of the reporting sheet. The following definitions should be considered.

- a) The programmes are organised around the GES descriptors, reflecting the different aspects of GES for which the monitoring needs to provide data.
- b) The sub-programmes are organised around the technical characteristics of monitoring, reflecting different data types and ways of collecting these data. More than one sub-programme can be allocated to each monitoring programme.

3.1. General description of the monitoring programmes

(Questions 1-4 of the Reporting sheet)

According to the European Commission (2014a, p. 14), the purpose of the general section of the reporting sheet is to:

- a) *Ask general questions that do not relate to a specific monitoring programme, such as the overall adequacy of the monitoring programmes for assessing progress towards GES and achievement of the targets, and to describe how the monitoring programmes will be able to identify new and emerging issues.*
- b) *Identify any gaps in coverage of the monitoring programmes and explain how and when these will be addressed.*

Question 1: Overall adequacy of the programmes

No	Topic	Question	Summary information
1a	Overall adequacy	Do the monitoring programmes as a whole constitute an appropriate framework to meet the requirements of the MSFD? If not, please complete the questions on gaps below.	Yes/No
1b	Gaps: GES descriptors and criteria (art. 9)	Which GES descriptors and criteria relevant for your marine waters (as included in your MS report for art. 9) are not yet adequately covered by your Monitoring Programmes?	For each Descriptor and Criterion indicate one of the following: <ol style="list-style-type: none"> a. It is adequately covered in your 2014 monitoring programmes; b. It will be addressed: <ul style="list-style-type: none"> • In time for the next assessment due in 2018 • In time for the updating of monitoring programmes due on 2020 • Later than 2020 c. It is not relevant.

Evaluation. The reported overall adequacy is characterised by subjectivity and variance in the way the MSs have conceived it. The subjectivity was obvious when the coverage of

the monitoring programmes and subprogrammes analysed across the MS and the replies were not comparable. The gaps in GES descriptors and criteria constitute very handy information about the fields that require more effort in terms of monitoring. However, as the in-depth assessment of the 2012 reporting (Palialexis et al., 2014) indicated, the GES determination was not consistently reported (different levels of determination - indicators, versus criteria versus descriptors; quantitative versus qualitative), and the direct link of the monitoring reporting with art. 8, 9 and 10 does not allow for a wide regional comparison.

Suggestion for improvement. The harmonisation of GES determination can improve the comparability and use of the reported information. The date when GES will be adequately covered for each descriptor and criterion is important information, which should be reassessed in the updates of the monitoring programmes to indicate the progress in the gap filling.

Box 1. The new GES Decision (2017/848/EU)

Beyond the harmonisation of the GES determination, it is essential to consider that the updates of the monitoring programmes due in 2020 will be based on the new Decision (European Commission, 2017a), which will jeopardise direct comparison with 2014 reporting and evaluation of the progress during the first MSFD cycle.

No	Topic	Question	Summary information
1c	Gaps: targets (art. 10)	Which targets and associated indicators for your marine waters (as included in your Member State report for art. 10) are not yet adequately covered by your Monitoring Programmes?	For each target, indicate one of the following: <ol style="list-style-type: none"> It is adequately covered in your 2014 monitoring programmes It will be addressed: <ul style="list-style-type: none"> In time for the next assessment due in 2018 In time for the updating of monitoring programmes due in 2020 Later than 2020 It is not relevant
1d	Gaps: Annex III elements (art 8)	Which elements from MSFD Annex III relevant for your marine waters (as reported in your Member State report for art. 8) are not yet adequately covered by your Monitoring Programmes?	For each Annex III element indicate one of the following: <ol style="list-style-type: none"> It is adequately covered in your 2014 monitoring programmes It will be addressed: <ul style="list-style-type: none"> In time for the next assessment due in 2018 In time for the updating of monitoring programmes due in 2020 Later than 2020 It is not relevant

Evaluation. Questions 1c and 1d are analogous to Question 1b for GES, but they refer to targets (art. 10 of the MSFD) and MSFD Annex III elements, respectively. The monitoring programmes are not directly comparable, because of the inconsistencies in the way the targets were conceived and reported by the MSs in 2012.

Suggestion for improvement. Once again, the harmonisation of the target setting, at least regionally, will improve the evaluation and comparability of the updated monitoring programmes. The new revised MSFD Annex III should be considered and, if possible, embedded in the reporting, e.g. as a drop-down menu, to enhance the comparability of the monitoring programmes and the consistency of the reporting.

No	Topic	Question	Summary information
1e	Gaps and plans	<p>Explain the gaps and describe your plans to complete coverage.</p> <p>Provide justification for not including specific GES criteria, environmental targets and Annex III characteristics in your monitoring programmes which you have reported under art. 8, 9 and 10 as being relevant to your Member State waters (e.g. based on risk assessment)</p>	Free text description or URL link or section in paper report

Evaluation. This question is crucial to identify and prioritise the gaps in the adequacy of the programmes. However, many MSs did not answer. When gaps and plans were reported, no details were provided, but references to the paper reports or other documents, preventing a regional or sub-regional overview of gaps and plans.

Suggestion for improvement. Although we acknowledge the importance of the detailed information on gaps, it would be more useful to insert an intermediate step, whereby the gaps can be grouped spatially (for each MS and region/sub-region) in several predefined categories (e.g. gaps at the level of descriptor, criterion, elements or method).

Question 2: Public consultation

The public consultation questions were not evaluated, because they are more of administrative than technical interest. This information can be archived for the updates of the monitoring programmes due in 2020.

Question 3: Other information

No	Topic	Question	Summary information
3a	Regional cooperation	<p>Where can additional information be found on your regional cooperation on monitoring programmes (if information is additional to that already provided under art. 6, 7, 8, 9 and 10)?</p> <p>Describe issues on cooperation that have not been reported before (under art. 7 or art. 8, 9 and 10), such as consistency in methodology.</p>	Provide URL web link or section in paper report.

Evaluation. The reported information for Question 3a is useful with reference to regional sea conventions (RSCs); however, similar information is reported at the level of monitoring programmes or sub-programmes, where it is more relevant to assign RSC activities to existing monitoring schemes. This information is essential to build an overview in light of potential regional collaborations.

Suggestion for improvement. To avoid potential duplications in the reporting it is suggested to limit the regional cooperation information at the level of sub-programmes. Then this information can be automatically aggregated to the higher levels.

No	Topic	Question	Summary information
3b	Transboundary impacts and features	Where can additional information be found on your consideration of transboundary impacts and features in monitoring programmes (art. 11.2b)?	Provide URL web link or section in paper report

3c	Major environmental changes and emerging issues	Where can additional information be found on the ability of the monitoring programmes to identify major changes in the environment (Annex V.11) and on the ability of the monitoring programmes to identify new and emerging issues (Annex V.11)?	Provide URL web link or section in paper report
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Evaluation. The transboundary impacts and features were not consistently conceived by the MSs, which reported them in the following ways, among others:

- a) references to RSCs;
- b) references to their paper reports;
- c) no specific information on impacts and features, but general references;
- d) not reported at all.

There was no consistent reporting regarding the major environmental changes and emerging issues, including mostly references to RSCs and to the paper reports. The major environmental changes and emerging issues reported were also inconsistent, showing once again the different perspectives of the MSs (partially reflecting the differences between the four regional seas of Europe in terms of pressures and priorities).

Suggestion for improvement. Both topics in 3a and 3b are very important, identifying needs for potential regional actions and driving the focus on specific regional/sub-regional environmental changes and issues. Moreover, this knowledge constitutes a suitable reference, against which the existing monitoring programmes can be evaluated. The transboundary impacts and features are essential to achieve GES at regional level; however, this perspective and information should be generated through regional cooperation (significant progress has already been done through the RSCs). More guidance is required to indicate potential transboundary impacts on each region or sub-region and to determine the major environmental changes that should be considered for the updating of the monitoring programmes.

No	Topic	Question	Summary information
3d	Source of contaminants in seafood	Where can additional information be found on chemical contaminants in species for human consumption linked to commercial fishing areas (Annex V.5)?	Provide URL web link or section in paper report or reference the relevant sub-programme for Descriptor 9
3e	Access and use rights	Where can additional information be found on how you intend to provide access and use rights in respect of data and information from the monitoring programmes (article 19 (3)), including: <ul style="list-style-type: none"> – the type of data – method/mechanism used to make it available – use rights for EC [European Commission]/EEA – INSPIRE (DIR 2007/2/EC) standards used – when the data will first be available – frequency of update of the data. 	Provide URL web link or section in paper report

Evaluation. Regarding the sources of contaminants in the seafood, there are references to reports, to national links or to the RSCs. Overall, the reported information is not readily accessible for immediate analysis.

Not all MSs reported the access and use rights, and those that provided information did so in a general manner without linking access and rights to particular data.

Suggestion for improvement. Question 3d should be omitted, as this information is reported at the sub-programme level.

Question 3e on the access and use rights, which is relevant to article 19(3) of the MSFD, is already reported at the sub-regional level, where it is more relevant and detailed. It can be omitted from the general questions.

Question 4: Competent authorities

The question on the competent authorities should be directly linked with the MSFD article 7 reporting, from which this information can be extracted and maintained for the coming reporting obligations.

3.2. Reporting on monitoring programmes

(Questions 4-8 of Reporting sheet)

According to the European Commission (2014a), the reporting at the level of the monitoring programmes is organised based on the GES Descriptors. Exceptionally, the biodiversity Descriptors (D1, 4 and 6) are grouped according to the main species groups and habitat types. The following monitoring programmes are to be reported:

Descriptor	MSFD Monitoring Programme
D1, 4	Biodiversity — birds
D1, 4	Biodiversity — mammals and reptiles
D1, 4	Biodiversity — fish and cephalopods ⁽²⁾
D1, 4	Biodiversity — water column habitats
D1, 4, 6	Biodiversity — seabed habitats ⁽³⁾
D2	Non-indigenous species
D3	Commercial fish and shellfish
D5	Eutrophication
D7	Hydrographical changes
D8	Contaminants
D9	Contaminants in seafood
D10	Litter
D11	Energy, including underwater noise

According to the European Commission (2014a, p. 20) the purpose of this section of the reporting sheet is to:

- a. *Ask questions that are specific to each programme, but apply generally to all its sub-programmes;*
- b. *This includes aspects on the adequacy of the programme for assessment against GES and progress with targets, (optional) links to (existing) measures and to existing monitoring programmes for other policies.*

The information collected in this section of the reporting sheet aims to describe the individual monitoring programmes in a more detailed and systematic manner than the general questions, with the intention that all questions are typically relevant to each programme. For each monitoring programme there are fields for a general description and metadata.

⁽²⁾ Refers to pelagic cephalopods.

⁽³⁾ Including seafloor integrity.

The main purpose of the monitoring programmes is to provide data to enable an assessment of environmental status in relation to the GES standard and to enable assessment of progress on the environmental targets set to achieve GES. Each monitoring programme is therefore assigned to a GES descriptor (or several for biodiversity topics), and potentially to specific criteria and/or GES characteristics (indicators). It is also necessary to link the monitoring programme to the features (e.g. species, habitats) and/or pressures to which it is relevant. Lastly, many programmes will also aim to provide data in relation to particular environmental targets, and this linkage should be indicated.

Question 4: About the programme

No	Topic	Question	Summary information
4d	Programme name	Give name of monitoring programme	Select one from List: Monitoring programmes
4e	Programme ID	Provide a unique identifier for programme	Use sub(region) and MS code (e.g. BALDE) plus MS-defined alpha-numeric code (e.g. MADIT-D08)

Evaluation. Not all MSs strictly followed the guidance to name their monitoring programmes, causing problems in the analysis and the grouping of the monitoring programmes at regional and sub-regional levels.

Suggestion for improvement. The options for Question 4d can be organised in a drop-down menu to facilitate the reporting and ensure consistency. The programme ID can be automatically assigned by selecting region or sub-region, country name and programme from drop-down menus. Such actions will ensure consistency in the reported information.

Box 2. Electronic versus paper reports

A general remark on the assessment of the monitoring reports is that those MSs that did not provide an electronic report deviated the most from the guidelines on the organisation and reporting of their monitoring programmes.

No	Topic	Question	Summary information	Additional guidance
4f	Programme description	Describe the overall approach of the monitoring programme, including: <ul style="list-style-type: none"> The rationale for your balance between monitoring of state/impact, pressures, activities and measures? How it adapts to new and emerging environmental problems (pressures and impacts) in relation to the relevant Descriptor(s). Include references/web-links where possible.	Free text description or URL link or section in paper report	The description of the approach to the monitoring programme should indicate which parts of the DPSIR [drivers, pressures, state, impact and response] model are being addressed, and any reasoning for not addressing all parts. More information on the DPSIR model is available here. It is not intended that responses should be lengthy, but rather that the issues raised have been considered. <p>Care should be taken not to repeat information that is required later under other questions about the monitoring programme or at the sub-programme level.</p>

Evaluation. The description of the monitoring programmes was, in most cases, lengthy and not always very informative, revealing the efforts of MSs to adapt their existing programmes to the MSFD concepts and structure. In other cases, the MSs provided web links to their paper reports or other national monitoring documents.

Suggestion for improvement. This entry provides interesting information; however, in the way it is reported it is impossible to extract and analyse it. Box 3 includes two general remarks in relation to this question.

Box 3. Free text and selecting the proper level for reporting

When free text is required, it should have word limits. Moreover, URLs can be useful as references or to avoid copying information from developed and agreed documents but are inappropriate for this kind of analysis. On the other hand, it is essential to have the monitoring programme’s description well organised, considering the importance of the knowledge in relation to:

- the balance between monitoring of state/impact, pressures, activities and measures,
- the basic MSFD concepts, such as the DPSIR.

An option to better organise this reporting field is to split the question into well-defined subquestions at a lower level, including the details described in the guidance on the question.

Each monitoring programme includes a different set of subprogrammes covering a mixture of state/impact, pressures, activities and measures for each descriptor. Therefore, it would be more efficient if this information were reported at the subprogramme level and then aggregated to the monitoring programme level. This remark can be generalised to many questions covering the monitoring programmes.

Question 5: Links to Articles 8 and 9 (GES and its assessment)

No	Topic	Question	Summary information	Additional guidance
5a	Relevant GES criteria	Which GES criteria are addressed by the monitoring programme?	Select all relevant from list in Decision	
5b	Relevant GES characteristics [indicators]	Which characteristics (indicators) are addressed by the programme?	GES are those defined by your art. 9 report Select all relevant from those defined by your art. 9 report	Q5b should reflect what was reported under art. 9, but the monitoring programmes may include additional indicators (e.g. from more recent work in Regional Sea Conventions) which will be used in future (2018) assessments, as well as indicators which provide supplementary information (e.g. on salinity and sea temperature) to support assessments.

Evaluation. Some monitoring programmes were not linked with criteria and indicators. In some cases, the reported criteria correspond to the wrong indicators. In other cases, the criteria and indicators are not assigned to each monitoring programme but are reported in a general manner or with different descriptions, not allowing easy quantification.

Suggestion for improvement. Prefilled drop-down menus for criteria, in line with the new Commission decision (European Commission, 2017a) would improve completeness and consistency in reporting. Linking the monitoring programmes with articles 8, 9 and 10 of the MSFD is essential to guarantee a smooth implementation across the three reporting obligations. This way, all elements and assessments, as well as the gaps, will be well reflected in the monitoring programmes.

No	Topic	Question	Summary information	Additional guidance
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5c	Relevant features, pressures and impacts from MSFD Annex III	Which elements of Annex III (ecosystem components, pressures/impacts) are addressed by the programme?	Select all relevant features and pressures from the Lists: <ul style="list-style-type: none"> - Functional groups - Predominant habitats - Physico-chemical features - Pressures 	The categories provided under Q5c are broad (as per the term lists for 2012 reporting), e.g. synthetic/non-synthetic substances. The specific elements being monitored within these broad categories should be reported under Q9a. The functional group categories should only be used for birds, mammals, reptiles, fish and pelagic cephalopods. Benthic invertebrates and macrophytes are part of the seabed habitats. Pelagic phyto- and zooplankton are part of the water column habitats. Use the 'reduced salinity' category for water column habitats in the Baltic and Black Seas.
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Evaluation. Lack of harmonisation in the reported elements — either too general groups or too detailed lists of species — makes the data difficult to process. In several cases this field contains information irrelevant to the question's requirements.

Suggestion for improvement. A detailed list of species, habitats and the revised MSFD Annex III elements should be assigned to each monitoring programme, using drop-down menus. This information could also be derived from the aggregation of the information reported at the subprogramme level.

No	Topic	Question	Summary information	Additional guidance
5d	Adequacy: assessment of GES (art. 8 & 9)	Will the programme provide adequate data to enable the periodic assessment of environmental status, and distance from and progress towards GES, including whether environmental status is improving, stable or deteriorating?	Adequate data: Yes or no?	'Data and information' refers to the information needed to assess whether GES has been achieved and if not, the distance to GES.
		If not, then complete Q5h.	Established methods for assessment: Yes or no?	If the answer is 'no' to one or more of the questions within Q5d, it suggests there are some gaps in the programme; some explanation of how the inadequacy will be addressed should be given in Question 5h.
			Adequate understanding of GES: Yes or no?	'Capacity' in this question refers to the necessary expertise and resources being available to perform assessments.
			Adequate capacity to perform assessments: Yes or no?	

Evaluation. This question was well addressed by the MSs and it can be easily quantified. However, when the information is integrated at regional level and compared with the more detailed information reported at the subprogramme level, it becomes obvious that the four categories (adequate data, established methods, adequate understanding of GES and capacity) are differently conceived and measured by the MSs. This information is essential to show commonalities across the MSs and gives an alternative perspective on gaps, developed methods and concepts in the GES determination.

Suggestion for improvement. GES determination needs to be further harmonised both conceptually and methodologically. The ongoing work on the harmonisation of the methods

to set thresholds for several descriptors will facilitate the reporting of this field. The MSs followed the sequence of the summary information column; however, to refine the monitoring reporting guidance we would suggest the logic described in the decision tree in Figure 2.

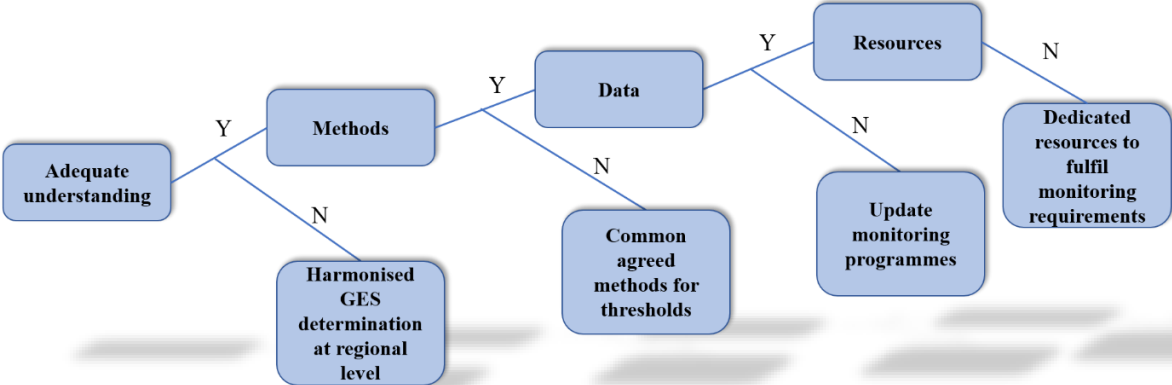


Figure 2. Decision tree to support the structure for reporting regarding adequacy for GES assessment.

No	Topic	Question	Summary information
5e	Natural variability	How does the programme address natural variability?	Select all relevant from List: Monitoring natural variability

Evaluation. Most of the MSs reported consistently on natural variability. The information is easily quantified and presented at different spatial scales.

Suggestion for improvement. The added value of this question at the level of the monitoring programme is questionable. Moreover, the natural variability in the subprogrammes can be aggregated at the programme level and include more than one of the given options on the list.

No	Topic	Question	Summary information	Additional guidance
5f	Description_GES	Describe how the programme: a. addresses assessment needs for the relevant Descriptor(s) and targets; b. meets the needs of providing data/information to support assessment of the Descriptor (or particular biodiversity component programme for D1, 4, 6); c. contributes to determining distance from GES and trends in status;	Free text or URL or descriptor is one of section in paper report	The determination of whether a descriptor is at GES or not is one of the main purposes of establishing monitoring programmes under the MSFD; this question should be answered so that it can be seen how the monitoring programme will contribute to determining GES. If GES has not been achieved, then it should be possible to establish the distance from GES.

		d. addresses natural and climatic variability and distinguish this from the effects of anthropogenic pressures;		
		e. responds to risks of not achieving GES.		

Evaluation. This is a key question for MSFD implementation, covering many aspects of GES. The MSs provided free text with URL web links, which did not allow quantification, evaluation and grouping of the reported information. The level of detail and the way each of the subquestions was reported were highly varied.

Suggestion for improvement. The work on the harmonisation of the methods to set thresholds for GES can harmonise the input for this field. Once again, word limits should be applied. The structure of the question and subquestions should be reconsidered, to facilitate the extraction of the appropriate information for evaluation and comparison purposes.

No	Topic	Question	Summary information
5g	Gap-filling date_GES	If not yet considered adequate for data and information needs, when will the programme be considered fully adequate?	Select one: a. Considered adequate in 2014 b. In time for the next assessment due in 2018; c. In time for the updating of monitoring programmes due in 2020; d. Later than 2020
5h	Plans_GES	If the programme is not considered fully adequate, what plans are in place to make it adequate (e.g. to fill gaps in data, methods, understanding or capacity)?	Free text or URL web link or section in paper report

Evaluation. The gap-filling date for GES comes from the predefined list and is easy to quantify. However, GES refers to different sets of criteria, indicators and elements, depending on what each MS has included in each monitoring programme. Varying information was reported for the MSs' plans to fully cover GES when their monitoring programmes did not yet cover GES. Many MSs did not report anything in answer to this question.

Suggestion for improvement. Once again, the work on the harmonisation of the methods to set thresholds for GES can be useful to harmonise the input for this entry.

Question 6: Links to Article 10 targets

No	Topic	Question	Summary information	Additional guidance
6a	Relevant targets (from art. 10)	Which target(s) are addressed by your programme?	Select all relevant target(s) (from the MS report on art. 10)	The list of targets provided is as reported by the MS in 2012.

6b	Adequacy: for assessment of progress with targets (art. 10)	Will the programme provide suitable and sufficient data and information to enable assessment of progress towards achievement of the relevant environmental targets (using indicators identified by the Member State under art. 10)	Suitable and sufficient data: Yes or No?	'Suitable and sufficient data and information' refers to the information needed to assess whether the targets are being achieved.
			Established methods for assessment: Yes or No? Adequate capacity to perform assessments: Yes or No?	If the answer is 'no' to one or more of the questions within Q6b, it suggests there are some gaps in the programme; some explanation of how the inadequacy will be addressed should be provided in Q6f.

Evaluation. This question refers to the targets reported in 2012. Since the targets were reported using the 2012 labelling, it was challenging to immediately identify the monitoring programmes with the associated targets for each monitoring programme and evaluate them. The adequacy for assessing progress towards the targets was easy to quantify, like the GES adequacy.

Suggestion for improvement. The comments made about GES (Article 9 of the MSFD) reporting and its link with the monitoring programmes are also valid for the targets (Article 10). Acknowledging the inconsistency in the target setting for Article 10 in the 2012 reporting (Palialexis et al., 2014; European Commission, 2014b) this entry is not very reliable for comparisons and evaluation. However, the progress made in the common understanding of the targets during the first cycle of MSFD implementation will improve the consistency in the updates for 2020. Once again, the new Commission decision should be considered in the guidelines for monitoring, but also in the structure of criteria in relation to the targets.

No	Topic	Question	Summary information	Additional guidance
6c	Target updating	Will the data and information collected enable the regular updating of targets?	Yes or No?	
6d	Description_Targets	Explain how the programme contribute to the assessment of progress with targets.	Free text or URL will web link or section in paper report	The linking of monitoring programmes to targets, and showing how they contribute to the assessment of progress with the targets is one of the main purposes of the monitoring programmes.

Evaluation. Question 6c was easy to quantify. Question 6d entailed a direct link to targets, causing similar issues to those mentioned in 6a regarding the inconsistency of the targets reported in 2012.

Suggestion for improvement. Same suggestions as made for the previous questions (6a, 6b).

No	Topic	Question	Summary information
6e	Gap-filling date_Targets	If not yet considered adequate for data and information needs, when will the programme be considered fully adequate?	Select one: a. Considered adequate in 2014 b. In time for the next assessment due in 2018; c. In time for the updating of monitoring programmes due in 2020; d. Later than 2020
6f	Plans_Targets	If the programme is not considered fully adequate, what plans are in place to make it adequate (e.g. to fill gaps in data, methods or capacity)?	Free text or URL web link or section in paper report

Evaluation. Question 6e was easy to quantify, like GES adequacy. The reported information for Question 6f was useful, but impossible to assess and quantify in the way it was reported as free text or URL web link.

Suggestion for improvement. Same suggestions as made for Questions 6a and 6b. In addition, the comments made about questions requiring free text or URL web links are also valid for this one.

Question 7: Links to Article 13 measures

No	Topic	Question	Summary information
7a	Relevant activities (from Art. 8.1c)	Which activities will the programme address?	List of relevant activities to be monitored (select from List: Activities from Art. 8.1c reports)
7b	Description_Activities	Describe the nature of activity and/or pressure monitoring (e.g. addressing spatial distribution, intensity and/or frequency of the activity) and how the programme is considered adequate to assess which activities and/or pressures are causing environmental change (degradation) and hence help identify possible new measures, if needed.	Free text or URL web link or section in paper report

Evaluation. For Question 7 an indicative list of the reported information is in Table 1. The list of possible activities to be reported in the guidance document greatly facilitated consistency in the reporting. For the description of the activities, the input varied, making it difficult to assess and quantify the reported information.

Suggestion for improvement. The activities can be easily grouped and consistently reported with the use of a drop-down menu. The comments about the questions requiring free text or URL web links are also valid for the description of the activities. At this reporting phase, this entry was optional, and therefore not very informative or complete, since the programme of measures under Article 13 of the MSFD was not yet reported. However, we expect that in the coming updates of the MSFD reporting this question will be very indicative of the progress of the implementation and for the accuracy of the links between the three MSFD reporting obligations per cycle.

Table 1. Indicative list of activities reported in 2012 for Article 8(1)(c)

Agriculture
Forestry
Anchorage area and places of refuge
Aquaculture
Beach nourishment
Biofuels: Ecosystem services
Cables/Pipelines
Carbon Sequestration: Ecosystem services
Coastal erosion
Coast Degradation
Cultural/Spiritual Well-Being: Ecosystem services
Defence
Desalination
Dredging
Dumping/Munitions
Environment For Tourism And Recreation (C1, C2)
Eutrophication
Extraction of non-living resources — other (sea salt extraction)
Fertiliser/Feed: Ecosystem services
Fisheries

No	Topic	Question	Summary information	Additional guidance
7c	Relevant measures	Optional: Which existing measures will the programme address?	List existing relevant measures that the monitoring programme addresses	As measures under MSFD Article 13 are to be defined for the first time by 2015, any existing measures reported here are without prejudice to Member State decisions on what is relevant for MSFD under Article 13. However, where monitoring of existing measures is already in place and these measures are expected to be included as MSFD measures in 2016, they can (optionally) be identified here. In subsequent reporting rounds (i.e. 2020 update on monitoring programmes), links to MSFD measures reported in 2016 can be made.

Evaluation. The reported information was varied and was difficult to assess and quantify.

Suggestion for improvement. Same suggestion as above (7a, 7b).

No	Topic	Question	Summary information
7d	Description_Measures	Optional: Describe the nature of monitoring of measures and how the programme enables their effectiveness (impact) in relation to delivering desired changes in environmental status to be assessed (e.g. what processes are in place to prove corrective measures are having the desired effect, and how is uncertainty quantified)?	Free text or URL web link or section in paper report

7e	Adequacy for assessment of measures (Art. 13)	Optional: Will the programme provide adequate data and information to enable the identification of activities and/or their pressures that are causing environmental degradation (and consequently suitable measures if needed) and the effectiveness of existing measures?	<p>Adequate data: Yes or no?</p> <p>Established methods for assessment: Yes or no?</p> <p>Adequate understanding of GES: Yes or no?</p> <p>Adequate capacity to perform assessments: Yes or no?</p> <p>Addresses activities/pressures: Yes or no?</p> <p>Addresses effectiveness of measures: Yes or no?</p>
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Evaluation. Neither question was addressed by most of the MSs. Since they were optional, and given the lack of information on the measures available by the reporting time, these questions were unlikely to be answered in the first MSFD cycle.

Suggestion for improvement. Same suggestion as those made for Questions 7a and 7b.

No	Topic	Question	Summary information	Additional guidance
7f	Gap-filling date_Activities_Measures	If not yet considered adequate for data and information needs, when will the programme be considered adequate?	<p>Select one:</p> <p>a. Considered adequate in 2014;</p> <p>b. In time for the next assessment due in 2018;</p> <p>c. In time for the updating of monitoring programmes due in 2020;</p> <p>d. Later than 2020.</p>	The 'data and information needs' are what the Member State considers necessary to meet the objectives of the monitoring programme (i.e. here in relation to assessing the effectiveness of measures).

Evaluation. Not all MSs have reported; however, the reported information can be easily quantified. The available information does not allow an adequate overview across regions or sub-regions regarding the date of the assessment of the effectiveness of the measures.

Question 8: Links to existing monitoring

No	Topic	Question	Summary information	Additional guidance
8a	Links to existing monitoring programmes	Which existing monitoring programmes already established under Community legislation or international agreements contribute to and are compatible with your MSFD programme?	Select the relevant instrument from Monitoring List: Directives/Conventions	These are existing programmes for EU policies or international conventions. This question is to provide a high-level link only to these other relevant monitoring programmes. As each policy may encompass a number of different monitoring programmes, specific details on which of these is being included in the MSFD programmes should be captured at sub-programme level under Q4I.
		Note: specific details are captured at sub-programme level — question 4m)		

Evaluation. Most of the MSs followed the guidelines. The quantification of this information is easy and informative (see **Figure 3**), allowing direct comparisons and indicating opportunities for harmonisation.

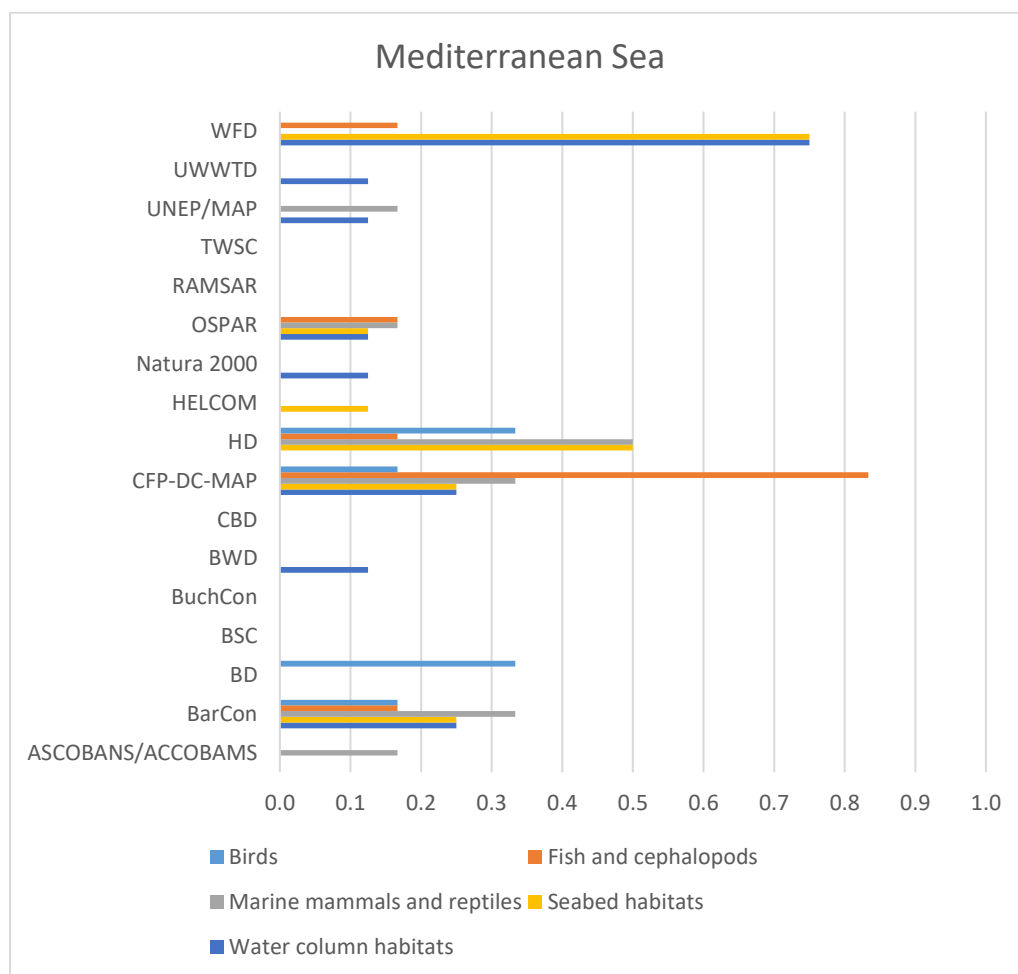


Figure 3. Quantification of the Mediterranean MSs' references to existing monitoring programmes for the Descriptor 1 species groups. The abbreviations of the Directives and Conventions comes from the 'List: Monitoring other Directives/Conventions' of the European Commission (2014a).

3.3. Reporting on subprogrammes

(Questions 4, 9 and 10 of Reporting sheet)

According to the European Commission (2014a), the purpose of this section of the reporting sheet was to:

- a. Ask questions that are specific to each sub-programme;
- b. This will typically address the specific aspect or features being addressed and the methods, spatial resolution and temporal periodicity of the monitoring.

Some basic characteristics of the subprogrammes are:

- a) multiple subprogrammes can be associated with a single monitoring programme, indicating, for example, different frequencies of sampling and methodologies;
- b) subprogrammes need to cross-reference multiple monitoring programmes, when their monitoring surveys collect data of relevance to several descriptors (e.g. plankton monitoring for use in D1, D4 and D5) for any step of the implementation (e.g. targets, GES or activities and measures);

- c) the reporting on the monitoring subprogrammes focuses on the actual data and information collected and is organised by similarity of purpose, elements monitored, data type and methodology.

The structure of the reporting of the subprogrammes for biodiversity, shown in Table 2 consists of the following questions:

- Question 4 requires metadata, and refers to the scope of the sub-programme;
- Question 9 describes the methodology of the sub-programme;
- Question 10 addresses the data generated by the sub-programme.

Table 2. Indicative list of MSFD monitoring sub-programmes for biodiversity.

Sub-programme	Purpose	Elements/features monitored	Parameter(s)	Descriptor	Criteria	
Q4g	Q4k	Q9a Only broad categories noted here	Q9b Typical parameters measured	Indicative only		
Mobile species – abundance and/or biomass	State/impacts	Highly mobile species	Species composition Species abundance (numbers of individuals and/or biomass) Species distribution (location)	D1, D2, D3, D4	1.1, 1.2, 2.1, 4.1, 4.3	
Mobile species – population characteristics			Body size (length, weight), age, sex, fecundity rate, survival rate, mortality rate	D1, D3, D4	1.3, 3.2, 3.3, 4.2	
Mobile species – health status			Species groups/functional groups or individual species of birds, mammals, reptiles, fish	D8	8.2	
Mobile species – state of habitats			(including commercial species), cephalopods	Habitat for the species (extent, suitability)	D1, D3	
Mobile species – mortality/injury rates from fisheries (targeted and/or incidental)				Rates of mortality, injury or other adverse effects from anthropogenic activities	D1, D3	1.2, 3.1
Mobile species – mortality/injury rates from other human activities					D1, D10	1.2, 10.2

Question 4: About the sub-programme

No	Topic	Question	Summary information
4g	Sub-Programme ID	Provide a unique identifier for sub-programme.	Use sub(region) and MS code (e.g. BALDE) plus MS-defined alpha-numeric code (e.g. MADIT-D08-01)

Evaluation. The MSs reported inconsistently, because they did not always follow the guidelines for the subprogramme identifiers.

Suggestion for improvement. The IDs for monitoring programmes and subprogrammes can be automatically assigned, using prefilled parts for the MSs, their region and sub-regions and descriptor.

No	Topic	Question	Summary information
4h	Temporal scope	Provide the start date of the sub-programme (past or future) and, if appropriate, an end date, or indicate the programme is ongoing	Start date: YYYY End Date: YYYY, 9999 (ongoing)

Evaluation. This is very useful information, providing an overview of the range of subprogrammes' duration. The analysis of these data indicated the differences in the number of new subprogrammes across regions, and also highlighted the different capacities in the assessments and the GES determination in relation to data availability (e.g. **Figure 4** for fish- and cephalopod-monitoring subprogrammes).

Suggestion for improvement. No suggestions for this question. However, the outcome of the analysis indicates that, the sooner we ensure full data coverage for GES and targets, the better for the harmonised and comparable implementation of the MSFD in all regions.

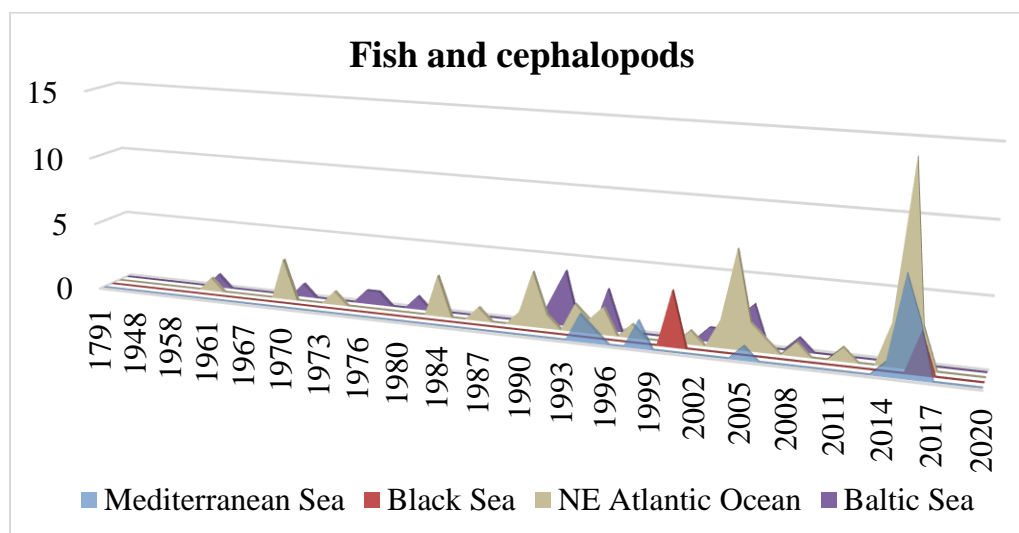


Figure 4. Temporal range of existing (before 2014) and future (after 2014) monitoring subprogrammes for fish and cephalopods, as reported by the MSs

No	Topic	Question	Summary information
4i	Spatial scope	Indicate the coverage of the sub-programme according to the four jurisdictional zones of MSFD Marine Waters (or outside this, either landward or beyond marine waters if appropriate, e.g. for pressures).	Select all relevant from List: Monitoring zones
4j	Description_Spatial Scope	Briefly describe the rationale for the geographic scope of the programme (e.g. in relation to relevant environmental characteristics, such as distribution of a species or habitat, to pressures or to relevant activities and measures).	Free text or URL web link or section in paper report

Evaluation. Question 4i provided useful information, which could not be quantified, either because of the many different options reported or because free text was inserted instead of the reference list. The structure of the reporting should foresee that some subprogrammes might cover more than one category from the reference list in Table 3.

Suggestion for improvement. It would be useful to have this information (as well as any spatial information in relation to the monitoring subprogrammes) on maps (e.g. GIS layers), to get an overview of coverage for each element group. Question 4j can be more specific and be reported in steps of prefilled information (e.g. step 1, ecosystem component: marine mammals; step 2, species group: baleen whales; step 3, criterion: distribution), which can be linked with Question 4i and the coverage of the appropriate monitoring zone.

Table 3. Reference list of monitoring zones to support the reporting of Question 4i

Monitoring zones	MS terrestrial part
	Water Framework Directive Transitional Waters
	WFD Coastal Waters
	Territorial waters
	Exclusive Economic Zone (or similar)
	Continental Shelf (beyond Exclusive Economic Zone)
	Beyond MS waters

No	Topic	Question	Summary information
4k	Purpose	For what purpose is this sub-programme aimed at collecting data and information?	Select all relevant from List: Monitoring purpose

Evaluation. The reported information was based on Table 4, which includes very broad categories. The added value of this entry needs to be further justified.

Suggestion for improvement. This information can be merged with Question 4f at the monitoring programme level and in relation to the DPSIR description. As was mentioned earlier, many different subprogrammes might be allocated to each monitoring programme,

so it is more suitable to have this information at the subprogramme level and then, if needed, to integrate it at the programme level.

Table 4. List of monitoring purposes for each sub-programme reported

Monitoring purpose	State/impact	Environmental state and impacts
	Pressures	Pressures
	Activities	Human activities causing the pressures
	Measures	Effectiveness of measures

No	Topic	Question
41	Links to programmes of other directives & conventions	<p>If monitoring for other Community legislation or international agreements is contributing to your MSFD programme (as indicated in Question 8a), give details as follows:</p> <ul style="list-style-type: none"> Name of other programme A specific URL web link(s) to where the information required for each part of Question 9 can easily be found and is directly relevant for your marine waters. Describe how the existing monitoring will contribute to MSFD needs including how it is integrated into your MSFD programme. <p>This field can also be used to link to a national programme.</p> <p>If the information required for each part of Question 9 is maintained on a permanent official website, Question 9 does not need to be completed.</p>

Evaluation. This question had hundreds of unique entries, because of the combinations of the reference information (Table 5). As a result it was hard to group the subprogrammes in relation to the relevant policies and agreements and in relation to their regional relevance.

Suggestion for improvement. The structure of the database where the XML responses are assembled can facilitate the data format for the required analysis. It is important to envisage beforehand the type of information that can be extracted from the reports, at different spatiotemporal levels and for different groupings of MSs.

Table 5. List of monitoring programmes under other policies or regional agreements for each subprogramme reported

Monitoring Directives/Conventions other	BWD	Bathing Water Directive
	CFP-DC-MAP	Common Fisheries Policy — Data Collection Framework (DC-MAP)
	Habitats	Habitats Directive
	Birds	Birds Directive
	NiD	Nitrates Directive
	UWWTD	Urban Waste Water Treatment Directive
	WFD	Water Framework Directive
	BarCon	Barcelona Convention UNEP/MAP
	BuchCon	Bucharest Convention
	HELCOM	Helsinki Convention
	OSPAR	OSPAR Convention
	WaddenSea	Trilateral Wadden Sea Cooperation
	Other	Other (specify)

Question 9: Methodology

No	Topic	Question	Summary information
9a	Elements monitored	Which elements (ecosystem components, pressures from MSFD Annex III) are monitored?	List the specific elements (e.g. particular species or contaminants) within the broad categories reported under Question 5c.

Evaluation. This information is very important, but the MSs' answers ranged from specific elements (e.g. species) to broad categories (e.g. cetaceans or broad habitats) or free text (Table 6). The reported information could not be easily analysed or quantified.

Suggestion for improvement. In updating the guidance for the monitoring reporting, it should be considered what the MSs have reported and a hierarchical structure should be built with predefined options following the new Annex III, e.g. theme/ecosystem element/parameter.

Table 6. Indicative list of what the MSs have reported

Diversity indices, species numbers, population abundance and habitat distribution, quality indices
Population abundance, biomass, leaf surface area per shoot, epiphyte biomass, habitat distribution, quality index (PREI)
Species group/Functional group: Seals — (Harbour seal <i>Phoca vitulina</i>)
Species group/Functional group: Seals — (Grey seal <i>Halichoerus grypus</i>)
Species group/Functional group: Turtles: Leatherback turtle (<i>Dermochelys coriacea</i>)
Coastal fish
Pelagic fish
Pelagic elasmobranchs
Demersal fish
Demersal elasmobranchs
<i>Micromesistius poutassou</i> (Risso, 1827) Blue whiting

No	Topic	Question	Summary information
9b	Parameters measured	What parameters of the elements are measured?	Choose from the List: Monitoring parameters, e.g. concentration in sediment, population size, intensity of pressure [full list to be developed].

Evaluation. The reported information was very consistent and useful. The reference list with the monitoring parameters secured consistent reporting.

Suggestion for improvement. No particular comments. The structure of this list and the philosophy behind it constitute a good practice that can inspire the formation of other reference lists.

No	Topic	Question	Summary information
9c	Monitoring method	What is the method used for monitoring (data collection) in the field and, where appropriate, any subsequent laboratory processing?	Provide a reference to a published method or, if unpublished, describe the method used.
9d	Method alteration	Describe the methods used if they deviate from the published method provided.	Free text or URL web link or section in paper report

		If this field is left blank it is assumed the method used is according to the published method given in Q9c.	
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Evaluation. From the methodological perspective, this was the most useful information to evaluate and to compare the methods reported at regional level and across elements. As was mentioned earlier for other questions requiring free text or URL web links and references, the reported information was not suitable for any kind of analysis, and the extraction of the appropriate information required a significant amount of effort and time. Table 7 provides an indicative list of the types of information reported for Question 9c. The inconsistency of the reported information and the challenge of grouping and analysing this information are obvious. To this end, following a deeper analysis for selected species and regions, we concluded that in many cases MSs reported a method that is also included in a national report, which comes from a regional agreement. In other cases, there are references to scientific papers describing methods that are adapted to national or regional monitoring without this adaptation being reported by the MSs.

Suggestion for improvement. The methods that are described in the scientific literature and are included in national or regional documents or even EU guidance documents should be reported, citing all these sources.

Table 7. Indicative list of what the MSs have reported

The monitoring methods of the Cyprus Turtle Conservation Project (Demetropoulos and Hadjichristophorou, 1995, 2008)
The monitoring methods are included in the MedITS survey instruction manual (MedITS WG, 2013).
UNEP/MAP (2005) and DFMR (2012c)
Cyprus MedITS annual reports
Argyrou et al. (2011)
Duck and Morris (2012a;b)
NPWS (2010)
Cadhla et al. (2013)
Surveillance monitoring: No national monitoring. However, turtle strandings and sightings are recorded and reported to University College Cork (UCC) who occasionally carry out necropsies on dead turtles. All records of are submitted to the TURTLE database.
ICES. 2014.ICES. 2013.
ICES working group standard (Working Group for International Pelagic Surveys, WGIPS)
Gerritsen and Lordan (2011)
EU logbooks are completed by the masters of fishing vessels when landing. Monitoring is according to specification in Council Regulation (EC) No 1224/2009 and Commission Implementing Regulation (EU) No 404/2011 in relation to Electronic Recording Systems (ERS).

No	Topic	Question	Summary information
9e	Quality Assurance (QA)	In addition to a specified method, is there any additional Quality Assurance used?	Select one from List: Monitoring QA
9f	Quality Control (QC)	What type of Quality Control is used?	Select one from List: Monitoring QC

Evaluation. Not all MSs answered this question, most probably because this information was not available for all monitoring subprogrammes (and the 'unknown' option was not selected). The available list of options was of great help.

Suggestion for improvement. A way to improve the quality assurance and quality control reporting is to enrich the reference list further (Table 8).

Table 8. Indicative list of quality assurance and quality control options for reporting

Monitoring QA	BEQUALM	Biological Effects Quality Assurance in Monitoring Programmes
	COMBINE	Helsinki Commission Cooperative Monitoring in the Baltic Marine Environment manual of measurement protocols
	ICESDataTypeGuide	ICES Data Centre Data Type Guides
	IODE	IOC Manual of Quality Control Procedures for Validation of Oceanographic Data
	JGOFSL1	Joint Global Ocean Flux Study core measurement protocols
	QUASIMEM	Quality Assurance of Information for Marine Environmental Monitoring in Europe
	National	National standard (specify)
	Other	Other standard (specify)
	Unknown	Unknown
Monitoring QC	DelayedValidation	Delayed mode validation on the data
	NoValidation	No validation on the data
	Real&DelayedValidation	Real-time plus delayed mode validation on the data
	RealValidation	Real-time validation on the data
	Other QC	Other type of QC (specify)
	Unknown	Unknown

No	Topic	Question	Summary information
9g	Spatial resolution (density) of sampling	What is the proportion of the geographic scope (given in Q4i) which is covered by sampling? This question is intended to provide a broad indication only of expected sampling density, as information on actual sampling locations, once collected, should be linked to Art. 19.3 on access to the monitoring data]	Approximate proportion (%)
		What is the density of sampling within the proportion given above?	Approximate number of samples expected to be taken from the assessment area (No./year)

Evaluation. The spatial resolution of the sampling was always reported, but did not always refer to the same level of information. For example, the spatial resolution reported for seals referred to:

- a) population abundance;
- b) by-catch;
- c) a subprogramme with no further specification about the sampling parameter.

The density of the sampling was not reported consistently enough, because it referred to different parameters within the same subprogramme.

Suggestion for improvement. The sampling strategy (e.g. random, transects) determines the proportion of the area covered; however, the reported information revealed that not all MSs have the same understanding or the same approach to reporting the coverage, indicating that more guidelines are required.

No	Topic	Question	Summary information
9h	Temporal resolution (periodicity) of sampling	What is the temporal frequency of the sub-programme?	Select one from List: Monitoring frequency
9i	Description_Sub-programme	Where the information for Questions 9a-9h varies within the sub-programme (e.g. spatially or temporarily), provide details. This could include, for example: <ul style="list-style-type: none"> variation in relation to risk across the area (e.g. coastal/offshore, pressure-related) variation due to differing management regimes (e.g. MPAs or other management zones) 	Free text or URL web link or section in paper report

Evaluation. Reporting was consistent across the MSs, but the temporal resolution might refer to different elements within the same subprogramme. The reference list of possible frequencies (Table 9) was very effective at ensuring a consistent approach.

Suggestion for improvement. Once again, when the options are grouped properly and are included in the report process as drop-down menus, they facilitate an in-depth analysis of the reporting, especially between MSs. Question 9i was not answered by most of the MSs, but it contains important information. More guidelines could further clarify what is expected for this question.

Table 9. Indicative list of monitoring frequency options for reporting

Monitoring frequency	Every 6 years
	Every 3 years
	Every 2 years
	Yearly
	6-monthly
	3-monthly
	Monthly
	2-weekly
	Weekly
	Daily
	Hourly
	Continually
	One-off
	As needed
	Other (specify)
Unknown	

Question 10: Monitoring data

No	Topic	Question	Summary information
10a	Aggregation of data	At which scale can the data from the sub-programme be aggregated for environmental assessments?	Select one from List: Monitoring data aggregation scale
10b	Description_DataAggregation	If 'other' is selected, describe the scale. If the data cannot be aggregated (beyond the national scale), give reasons?	Free text or URL web link or section in paper report

Evaluation. Most MSs reported 'other', indicating a lack of harmonisation in the way data are aggregated. Furthermore, most of the ongoing monitoring programmes from other legislation cover the national spatial range. At the reporting period the RSCs had rarely discussed and agreed methods to aggregate information beyond national waters. The list in Table 10 shows the possible options for the data aggregation scales, which facilitated consistency in the reporting.

Suggestion for improvement. The progress in the first MSFD cycle in relation to the integration and aggregation of information and assessments across indicators, criteria and elements will improve the report updates for this entry. The aggregation and integration of information is essential for the harmonisation of the MSFD implementation, and the work done and coordinated by the RSCs should be reflected in the updates of this question. The comments about those entries requiring free text or URL links are also relevant to Question 10b. More guidelines and options should be included in the list to make this entry more informative.

Table 10. Indicative list of options for the data aggregation scales

Monitoring data aggregation scale	Sub-region
	Region
	EU
	Other
	Unknown

No	Topic	Question	Summary information
10c	Access to data	Nature of data/information to be made available:	Select one or more from List: Data type
		What method/mechanism will be used to make the data available?	Select from List: Data access mechanism
		Will the EC/EEA have use rights?	Select one from List: Data access rights
		Which INSPIRE standard is/will be used?	Select one from List: INSPIRE standards

		When will the data first become available?	Date: MM/YYYY
		How frequently are the data expected to be updated thereafter?	Select one from List: Monitoring frequency

Evaluation. The lists (Table 11) providing possible options for data type, data access mechanisms and rights contributed to consistent reporting for Question 10c.

Suggestion for improvement. Once again, consistent reporting of information is essential to allow the direct analysis of the database generated from the XML files (or even the paper reports) and the in-depth assessment of the MSs' reporting at regional or EU-wide range. This kind of analysis will channel effort to the gaps, highlight good practices and streamline the monitoring methods across the regions and elements. However, in many cases the answer to a simple request (e.g. Date: MM/YYYY in Question 10c) was combined with extra information (especially text) or was not reported consistently. As a result, even for a simple kind of information it becomes very challenging to provide an in-depth assessment without modifying the reported information in the proper format for analysis. Table 12 shows some of the information compiled from the MSs' monitoring reports, selected to exemplify the variety and inconsistency of information reported, in a case where the expected entry is a single date. Automated tools, limited entries and selection menus could facilitate consistent and comparable reporting of information.

Table 11. Indicative list of options for the data aggregation scales

Data type	UnprocessedData	Unprocessed/raw data
	ProcessedData	Processed data sets
	DataProducts	Data products
	Modelled data	Simulated (modelled) data
Data access mechanism	URLview	Providing URL to view data
	URLdownload	Providing URL to download data
	Location national DC	Provide location of data in national data centre
	Location international DC	Provide location of data in international data centre (e.g. RSC, ICES, EEA, EMODnet)
Data access rights	Open	Open access
	Moratorium	Moratorium
	RestrictedGeneral	Restricted by general licence
	RestrictedSpecific	Restricted by specific licence
	Not available	Data will not be available

Table 12. Indicative list of options for the data aggregation scales

06_2015
2011
1978
1990 (Data are typically made available within 4 months of survey end.)
1995 (Data typically made available within 4 months of survey end.)
2012 (Data typically made available within 4 months of survey end.)
2006(Data typically made available 12 months after collation/download.)
2009 (Dependant on data call and analysis. typically made available to STECF/ICES 12-18 months after collation/collection.)
2009
12/1994 (1994 for discard, 2010 for sampling at sea in its current format. Data typically made available 8 months after collection year).
1999 (Data available from 1999-present, updated on an annual basis to international data centres.)
2002 (HABs monitoring programme for shellfish and phytoplankton initiated since 2002.)
2011 (In general, data are made available 6-12 months after its collection and analysis.)
2014
2010 (Currents, temperature and salinity simulated data available from 2010. Wave simulated data available from mid-2010. Most recent data available from Marine Institute data access programme server.)
Unknown. (Access to data from satellites is complex. Re-use and redistribution of data originating from EC funded activities such as Copernicus needs to be negotiated with the data originator at the EC level.)

4. Discussion

4.1. Consistency and completeness in the reports

A key aim of the reporting sheet was to provide the information content in a standard format, as this has the following benefits (European Commission, 2014a):

- a. *The information is in a structured format to enable easier review across multiple Member States;*
- b. *The information can be readily aggregated into a common database for subsequent summary and analysis (e.g. for Article 12 assessment);*
- c. *The information is in a common format for dissemination (e.g. through WISE [Water Information System for Europe]-Marine).*

The in-depth assessment of the MSs' monitoring reports evaluates the level of achievement of the key aims of the reporting sheet.

The MSs dedicated an outstanding amount of effort to collecting, analysing, planning, establishing and reporting their monitoring programmes for the MSFD. This exercise adds value to the high-level objective of the MSFD — to achieve or maintain GES — since it provides an overview of the available information and gives the opportunity to fill in the gaps in any of the MSFD requirements. To this end, the first benefit of the reporting sheet is verified, as we were able to straightforwardly review the reported information across MSs. If all MSs had reported using the reporting sheet, then the in-depth assessment of the monitoring reports would be much easier and more informative.

Box 4. Suggestion for reporting

MSs are encouraged to organise their monitoring reports in accordance with the reporting sheet, which provides the structure of the required information covering the needs of all relevant parties (the MSs, the European Commission and the RSCs).

The second benefit of the reporting sheet relates to the aggregation of information into a common database for subsequent summary and analysis (e.g. for Article 12 assessment or for this exercise). The analysis showed that this was partially achieved. It is essential to keep in mind that at least the first cycle of the MSFD is a heuristic process. It was very challenging in the first cycle to identify the information needed and properly synthesise this information in accordance with the MSFD concepts and nomenclature. Given this, only after the conclusion of the reporting are we in a position to completely evaluate the reporting sheet and whether or not the quality/type/format of the reported information is in line with the MSFD expectation. Some of the reported information was indeed immediately used for the Article 12 assessment (European Commission, 2014b). However, the deeper we go into the technicalities and details of the monitoring (sub)programmes, the less consistent and harmonised the information becomes, and thus less appropriate for aggregation and analysis. A major objective of the present document is to further improve and harmonise the level of consistency for each of the unclear entries.

Regarding the last benefit of the reporting sheet, it definitely supports a common format for dissemination (e.g. through WISE-Marine); however, a lot of effort is required to ensure that the reported information will have the right quality and consistency to be disseminated, as a concrete and meaningful product. The refinement of the reporting sheets based on our findings will contribute to this direction.

The European Commission (2014a) had identified possible uses of the reported information on the monitoring programmes, beyond the legal obligation under Article 11 of the MSFD:

- a. *For national purposes to support development and implementation of monitoring programmes, including use at policy level and for technical delivery;*
- b. *For stakeholders and the public, to inform them of the programmes;*

- c. *For neighbouring countries and regional organizations (e.g. Regional Sea Conventions) to foster cooperation within the (sub)region;*
- d. *For EU level to inform the Commission and others of the Member State implementation.*

The in-depth analysis of the MSs' reports and the structure of the reported information indicated that all of those uses can be fully covered. Improvement in the consistency of the reporting will also benefit the MSs, the Commission and the other stakeholders that can make use of the reported information.

4.2. Evaluating the methodological approaches for monitoring

One of the basic objectives of this work was to identify best practices within the reported monitoring methodological standards and seek for potential collaborations for joint monitoring programmes and methods to fill in the gaps at (sub)regional level. The extraction of methodological approaches had to be focused on a specific parameter belonging to a certain criterion in a single descriptor, because of the vast amount of reported information. Consequently, the extraction and the spatial comparison of the methodological approaches resulted in the following conclusions.

- a) The reported methodological approaches for monitoring, as well as their characteristics (frequency, density, etc.) at the level of subprogrammes, can be reviewed and harmonised at (sub)regional level.
- b) In many cases, the reported methodological standards are the same, which is not immediately obvious, because the same methods are not consistently reported. These were usually reported by reference to different sources (scientific publications, national and regional reports), although all of them were citing the same method.
- c) The MSs were forced to adapt established monitoring programmes, which had come into force before the MSFD, to the MSFD concepts (e.g. DPSIR) and structure (criteria and indicators). The data collection framework of the common policy framework and the RSC monitoring programmes are among these. The adaptation effort was not always coherent, resulting in inconsistent numbers of subprogrammes and different ways of structuring programmes' characteristics and allocating them on the reporting sheet.

The methodological approaches for monitoring provide the most crucial information for evaluation and review, from the technical and implementation perspectives. They are linked with the implementation of Article 9 of the MSFD for GES determination, the methods of setting thresholds, and the targets to achieve and maintain GES. Given this, an overview of the methodological approaches to monitoring provides essential information about the quality of the data required for implementing the MSFD and for the information gaps that can be filled by the establishment of new monitoring programmes.

4.3. Implementation of monitoring programmes

The reporting sheet is closely linked to the implementation of the MSFD through the three reporting obligations (initial assessment, GES determination, targets; monitoring programmes; and programmes of measures), which is essential to secure consistent connection with each step. The monitoring reporting provides the appropriate opportunity within the MSFD cycle for the MSs to cover any data gap that emerges from the developments and progress in methodological standards and assessment methods. However, the current reporting structure does not include a mechanism to evaluate the progress of the implementation of the new monitoring programmes proposed by the MSs, at least not before the updates in the next cycle.

Annex V of the MSFD sets out the content of the monitoring programmes in respect of implementation and reporting. The list of recommendations in Annex V of the MSFD can be applied to cross-check the completeness of the reporting.

Box 5. Suggestion for the structure and content of the reporting sheet

The reporting sheet is organised top-down, from the general information to the monitoring programmes and subprogrammes. Our analysis showed overlaps in the last two levels and inconsistencies in the allocation of information to the programme/subprogramme questions. It should be tested if another approach can be more effective for reporting. A suggestion is to:

- a. organise the relevant programmes;
- b. assign subprogrammes to them;
- c. fill in the technical characteristics of the subprogramme;
- d. aggregate (automatically if possible) the technical details for all subprogrammes at the programme level (e.g. if the 'monitoring from other directives or conventions' is under CFP for one subprogramme and under OSPAR for another, this information will be raised to the programme level as well).

Another important suggestion for the preparation of the monitoring programme reporting is to update the reporting sheet, acknowledging all the changes that the new GES Decision (European Commission, 2017a) has brought about, but exploiting the current reported information in the best possible way.

4.4. Evaluating the criteria elements reported for D1

The technical evaluation of the MSs' monitoring reports was focused on the biodiversity descriptors. The amount of biodiversity information reported was huge, and the comparison of methodological approaches was feasible only at the level of specific species groups (e.g. the monitoring subprogrammes for marine turtles). Comparing both the ongoing and the future monitoring programmes for species and habitats with the lists of species and habitats that the MSs should consider for the MSFD (Palialexis et al., 2018), only a small proportion is covered by the monitoring programmes. However, in many cases the monitoring subprogrammes referred to numerous species (e.g. marine birds) without naming them, jeopardising the objectivity of the comparison. Nevertheless, the 2014 reporting provides a better understanding of the prioritisation of criteria elements in the coming assessments (MSFD Common Implementation Strategy, 2017; Walmsley et al., 2017).

Box 6. Reference lists of criteria elements

The lists of criteria elements that facilitated the reporting for the MSFD Article 8, 9 and 10 updates in 2018 should be updated and applied to the monitoring reporting as well. A common basis of criterion elements (species and habitats for D1) can facilitate the effort to harmonise the methods for monitoring, for assessments and for setting threshold values. In addition, the methodological harmonisation will result in more consistent reporting.

The new Commission Decision on GES (European Commission, 2017a) was enriched with significant guidelines on 'Specifications and standardised methods for monitoring', which the MSs should consider. The biodiversity guidelines are compiled and listed in Annex 1 of this document.

5. Conclusions

This is a summary of the general findings from the in-depth assessment of the MSFD monitoring reports, in relation to biodiversity (Descriptor 1).

5.1. General comments

- a) Most of the MSs made a great effort to fulfil the MSFD reporting requirements for the biodiversity descriptor.
- b) The evaluation of the reporting sheet for monitoring programmes revealed some questions that were differently understood by the MSs. Given this, the reporting information for these questions is characterised by lack of consistency and of harmonisation.
- c) The reported information did not fully succeed in providing a spatial overview of the current monitoring status of biodiversity, at (sub)regional level.
- d) Revision and refinement of the reporting sheet will improve the monitoring updates for the MSFD due in 2020. Some questions in the reporting sheet need to be reframed or further explained in an updated guidance document.
- e) The extraction of methodological standards for monitoring and subsequently the regional evaluation of potential synergies and good practices were not an easy task. Substantial time and effort was invested to extract monitoring methods and strategies for selected species groups and selected regions or sub-regions.
- f) The monitoring programmes constitute a powerful method for the MSs to tackle their gaps in data and information. However, the evaluation of the MSs' reports revealed that the new monitoring programmes do not sufficiently cover the gaps reported at the beginning of the first MSFD cycle, at least in terms of species and habitats.
- g) The harmonisation of assessment methods across the MSs becomes very challenging considering the differences in data availability and in the length of the available data series.

5.2. For the next cycle

- a) The reporting sheet should be in line with the new requirements derived from Commission Decision 2017/848/EU.
- b) The improved harmonisation of monitoring reports with GES (Article 9) and targets (Article 10), following the 2018 updated reports for Article 17, will have a positive impact on the future monitoring reports. These updates should be reflected in the prefilled entries for the monitoring reporting.
- c) A bottom-up approach might increase consistency in the reporting, by aggregating the low-level information to the monitoring programmes. More guidance is required on how, for example, D1 monitoring can support the monitoring for other descriptors, e.g. D3 (fisheries) and D9 (contaminants in seafood).
- d) It is essential to exploit synergies for joint monitoring at regional level.

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Annex 1.

Commission Decision 2017/848/EU specifications and standardised methods for monitoring for species, pelagic and benthic habitats.

Specifications and standardised methods for monitoring and assessment relating to theme 'Species groups of marine birds, mammals, reptiles, fish and cephalopods'

1. For D1C1, **data shall be provided per species per fishing metier** for each **ICES area** or **GFCM Geographical Sub-Area** or **FAO fishing areas** for the Macaronesian biogeographic region, to enable its aggregation to the relevant scale for the species concerned, and to identify the particular fisheries and fishing gear most contributing to incidental catches for each species.
2. 'Coastal' shall be understood on the basis of physical, hydrological and ecological parameters and is not limited to coastal water as defined in Article 2(7) of Directive 2000/60/EC.
3. Species may be assessed at **population level**, where appropriate.
4. Wherever possible, the assessments under **Directive 92/43/EEC**, **Directive 2009/147/EC** and Regulation (EU) **No 1380/2013** shall be used for the purposes of this Decision:
 - (a) for birds, criteria D1C2 and D1C4 equate to the 'population size' and 'breeding distribution map and range size' criteria of Directive 2009/147/EC;
 - (b) for mammals, reptiles and non-commercial fish, the criteria are equivalent to those used under Directive 92/43/EEC as follows: D1C2 and D1C3 equate to 'population', D1C4 equates to 'range' and D1C5 equates to 'habitat for the species';
 - (c) for commercially-exploited fish and cephalopods, assessments under Descriptor 3 shall be used for Descriptor 1 purposes, using criterion D3C2 for D1C2 and criterion D3C3 for D1C3.
5. Assessments of the adverse effects from pressures under criteria D1C1, D2C3, D3C1, D8C2, D8C4 and D10C4, as well as the assessments of pressures under criteria D9C1, D10C3, D11C1 and D11C2, shall be taken into account in the assessments of species under Descriptor 1.

Specifications and standardised methods for monitoring and assessment relating to theme 'Pelagic habitats'

1. 'Coastal' shall be understood on the basis of physical, hydrological and ecological parameters and is not limited to coastal water as defined in Article 2(7) of Directive 2000/60/EC.
2. Assessments of the adverse effects from pressures, including under D2C3, D5C2, D5C3, D5C4, D7C1, D8C2 and D8C4, shall be taken into account in the assessments of pelagic habitats under Descriptor 1.

Units of measurement for the criteria:

— D1C6: extent of habitat adversely affected in square kilometres (km²) and as a proportion (percentage) of the total extent of the habitat type.

Specifications and standardised methods for monitoring and assessment relating to theme 'Benthic habitats'

1. The status of each habitat type shall be assessed using assessments (such as of sub-types of the broad habitat types) under Directive **92/43/EEC** and Directive **2000/60/EC**, wherever possible.
2. Assessment of criterion D6C4 shall use the assessment made under criterion D6C1.

3. Criteria D6C4 and D6C5 equate to the 'range/area covered by habitat type within range' and 'specific structures and functions' criteria of Directive **92/43/EEC**.

4. For D6C5, assessments of the adverse effects from pressures, including under criteria D2C3, D3C1, D3C2, D3C3, D5C4, D5C5, D5C6, D5C7, D5C8, D6C3, D7C2, D8C2 and D8C4, shall be taken into account.

5. For D6C5, species composition shall be understood to refer to the lowest taxonomic level appropriate for the assessment.

Units of measurement for the criteria:

— D6C4: extent of habitat loss in square kilometres (km²) and as a proportion (percentage) of the total extent of the habitat type,

— D6C5: extent of habitat adversely affected in square kilometres (km²) and as a proportion (percentage) of the total extent of the habitat type.

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