Comparisons and synthesis of the main elements of the GES and the monitoring programs of the 1st and 2nd cycles of the MSFD, reported by the European Member States for Descriptor 2 (non-indigenous species) - Analyses between countries and versus France

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March 2021

UNITÉ MIXTE DE SERVICE
PATRIMOINE NATUREL

Programme/Projet name: Directives Milieu Marin - DCSMM

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Reviewers : Cécile Massé and Anne Souquière (UMS PatriNat), Clémence Corbeau (MTES/DEB/ELM1)

Recommended report reference: Lizińska A. and Guérin L., 2021. Comparisons and synthesis of the main elements of the GES and the monitoring programs of the 1st and 2nd cycles of the MSFD, reported by the European Member States for Descriptor 2 (non-indigenous species) - Analyses between countries and versus France. UMS PatriNat (OFB, MNHN, CNRS). Station marine de Dinard. 34 p.

The Patrimoine naturel – PatriNat joint unit

Expertise and Data Center on Nature

Since January 2017, the "Patrimoine Naturel" joint unit conducts missions on expertise and management of knowledge for its three supervisory administrations, which are the French Natural History Museum (MNHN), the French Office for Biodiversity (OFB) and the French Scientific Research Center (CNRS).

Its main objective is to provide expertise based on collection and analyses of data on biodiversity and geodiversity occurring in the French territories, and on mastering and providing new knowledge on ecology, evolution sciences and anthropology. This expertise, scientifically based approach, aims to contribute to clarify questions and propose answers to improve public policies on biodiversity, geodiversity and its relationships with societies and humans.

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To produce this important source of information, the Museum built a database linking data through taxonomic, geographic and administrative referential. It is thus possible to access lists of species by a municipality, by protected area or by 10x10 km mesh. Thanks to these reference systems, it is possible to produce summaries, whatever the source of information.

This information system makes it possible to consolidate information, which was previously dispersed. It concerns the mainland and overseas, both on land and at sea. It is a major contribution to naturalist knowledge, expertise, research in macro-ecology and the development of effective conservation strategies for natural heritage.

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Glossary of acronyms :

BSIMAP	Convention for the Protection of the Black Sea Against Pollution
BS-SAP	Black Sea Strategic Action Plan
BWSC	International Convention on Ballast Water Management
CBD	Convention on Biological Diversity
CFP	Common Fish Policy
Council Regulation 1143/2014	Regulation (EU) No. 1143/2014 of the European Parliament and the Council on the prevention and management of the introduction and spread of invasive alien species
Council Regulation 708/2007	REGULATION (EC) No 708/2007 concerning the use of alien and locally absent species in aquaculture
CPs	Contracting Parties to the Regional Seas Conventions,
DCF	Data Collection Framework
EU	European Union
EEZ	Exclusive Economic Zone
GES	Good Environmental Status
Habitats Directive	Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora
HELCOM	The Baltic Marine Environment Protection Commission
MSPD	Directive 2014/89/EU of the European Parliament and of the Council establishing a framework for maritime spatial planning
MED	Mediterranean Sea
MedITS	An international bottom trawl survey in the Mediterranean
MPA	Marine protected areas
MSFD	Marine Strategy Framework Directive
NEA	North-East Atlantic
NIS	Nonindigenous species
OSPAR	The Convention for the Protection of the Marine Environment of the North-East Atlantic
RAMSAR	Convention on Wetlands of International Importance especially as Waterfowl Habitat
RSC	Regional Sea Convention
UNEP/MAP	The Mediterranean Action Plan
WFD	Water Framework Directive
WISE	Marine Information System for Europe, MSFD Reporting Data Explorer

SUMMARY

1 Introduction

1.1 MSFD context and recent history of French and European elements to assess Descriptor 2

The Marine Strategy Framework Directive (MSFD, 2008/56/EC) is the European Union's (EU) legislative pillar for the management and protection of marine biodiversity, aiming to define, assess and achieve Good Environmental Status (GES) of European marine waters by 2020. The Directive applies to marine regions and sub-regions, defined based on geographical, administrative, and environmental criteria.
Cooperation for coherence between the Member States of a marine region, and with neighbouring countries sharing the same waters, takes place through working groups, and the regional seas conventions for biodiversity and non-indigenous marine species. To achieve the GES, each Member State must develop a strategy for its marine waters, which must be reviewed and reported every 6 years.

In 2017, new GES criteria[1] have been established in Commission Decision (EU) 2017/848, for Descriptor 2; " Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystems":

D2C1 — Primary: The number of non-indigenous species which are newly introduced via human activity into the wild, per assessment period (6 years), measured from the reference year as reported for the initial assessment under Article 8(1) of Directive 2008/56/EC, is minimised and where possible reduced to zero. Member States shall establish the threshold value for the number of new introductions of non-indigenous species, through regional or subregional cooperation.

D2C2 —Secondary: Abundance and spatial distribution of established non-indigenous species, particularly of invasive species, contributing significantly to adverse effects on particular species groups or broad habitat types.

D2C3 — Secondary: Proportion of the species group or spatial extent of the broad habitat type which is adversely altered due to non-indigenous species, particularly invasive non-indigenous species. Member States shall establish the threshold values for the adverse alteration to species groups and broad habitat types due to non-indigenous species, through regional or subregional cooperation.

There are no longer "indicators" in this revised Decision but rather references to methodological standards such as building blocks or assessment scales.

In line with the updated GES criteria of Descriptor 2, and with the conclusions of the European Commission's Article 12 analysis (European Commission, 2015), the definition of the GES and the elements of the French monitoring programs have been updated and published respectively in the Interministerial Decree of 9 September 2019, and in the summaries for public consultation of the strategic documents. These main elements are summarized in Table 1 and details are available in Massé and Guérin (2017; 2018 and 2020).

[1] One primary and two secondary criteria have been defined for D2. The secondary criteria can be used to complement the primary criterion or where there is a risk of good ecological status not being achieved or maintained.

Table 1: criteria, elements, associated methodological standards and references of the GES definition and the monitoring of Descriptor 2 at the French level (after Massé and Guérin, 2018)

GES criterium	**D2C1 -** primary	D2C2 – secondary	**D2C3** – secondary
Elements of the criteria	Newly introduced NIS	Established NIS, including invasive species, including relevant species from the list of invasive alien species of Union concern adopted by Article 4 (1) of Regulation (EU) No 1143/2014, and species which may be used within the framework of criterion D2C3. Member States cooperate at regional or sub-regional levels to establish the list of species concerned.	Groups of species and main types of habitats threatened by NIS, chosen from those used for descriptors 1 and 6. Member States cooperate at the regional or sub-regional level to establish the list of groups of species and major types of habitats concerned.
Methodological standards	Rating scale: Subdivisions of the region or subregion divided if necessary, by national boundaries. Application of the criteria: The degree of achievement of GES is expressed as follows for each area assessed: Number of newly introduced NIS except for single-celled species, through human activities during the six-year assessment period and list of these species	**<u>Rating scale:</u>** The same as that used for the assessment of groups of species or major habitat types corresponding to Descriptors 1 and 6. **<u>Application of the criteria:</u>** Criterion D2C2 (quantification of non-indigenous species) is expressed by species assessed and contributes to the evaluation of criterion D2C3 (adverse effects of non-indigenous species). Criterion D2C3 provides the proportion by a group of species and the area per major habitat type assessed that are adversely affected and thus contributes to the assessment of these parameters under Descriptors 1 and 6.	
Indicator regional OSPAR et UNEP-MAP	NIS3 (OSPAR): trends in new NIS introductions Common 6 (UNEP / MAP): Trends in abundance, temporal occurrence, and spatial distribution of NIS	Common 6 (UNEP / MAP): Trends in abundance, temporal occurrence, and spatial distribution of NIS	No
Indicator national	NIS3 (OSPAR): trends in new NIS introductions	NIS-rep: trends in the spatial distribution of NIS populations	NIS-habitat: the proportion of the spatial extent of habitats impacted by NIS
D2 monitoring routines	SP1: introduction of non-indigenous species by the main vectors (water and ballast sediments, biofouling, transfers of living organisms, etc.). SP2: dedicated monitoring in risk areas and areas sensitive to biopollutions	SP2: dedicated monitoring in risk areas and areas sensitive to biopollutions SP3: characterization of the state and impacts of non-indigenous species	SP3: characterization of the state and impacts of non-indigenous species

1.2 Methodology and sources of information

This study aims to synthesize and compare the main elements reported by the European Member States for the MSFD, and concerning those reported by France, under Article 9 (definition of good ecological status) and Article 11 (monitoring programs), for Descriptor 2.

The first cycle of implementation of this directive took place between the years 2012-2018. The detailed historical background, synthesis, and analysis of this first GES reporting cycle and the monitoring programs have been published in a previous report (Lizińska and Guérin, 2020). The present report takes up these elements of synthesis of the first cycle, to follow its evolution, and continues this study with the synthesis and analysis of the elements available for the 2nd cycle MSFD: 2018-2024 for the Good Environmental Status (GES) and 2020-2026 for the monitoring programs. The elements reviewed for the 2nd MSFD cycle were to be reported by the Member States in 2018 for the update of the GES, and in 2020 for the update of the monitoring programs. These official reports were researched and collected via the dedicated European portal EIONET (http://cdr.eionet.europa.eu). For the GES, data from the WISE portal (https://water.europa.eu/marine) were also used to complement and double-check the information collected. Google translation was used to extract information from some reports in a national language not usual for the authors. All this information is presented in Table 2. The references to the documents (HTML and text) available and used here are listed and detailed at the end of this report (paragraph 9).

Of the 23 Member States, the GES update was reported in 2018 by only two countries: Belgium and the Netherlands. In 2019, thirteen more countries reported, including France, and seven more in 2020. At the time of this analysis, only Bulgaria had not yet reported the revised GES elements for the 2nd MSFD cycle. In October 2020, the first monitoring programs started to be reported and officially accessible online on EIONET. By the end of 2020, the HTML version of the reports was available for eleven Member States (Belgium, Croatia, Germany, Netherlands, Denmark, Estonia, Finland, Italy, Lithuania, Romania, Sweden), seven of them with their text reports. Only the text report was available for Spain. Eleven countries had not yet reported anything (neither HTML nor text) on their 2nd cycle monitoring at the time of this analysis. In the national reports (text or HTML), formatted for this European report, few details were available in addition to the standard elements, particularly on the sampling strategies or the protocols used. The rare additional and more detailed information, when available, were compiled in Annex 1 of this report.

Given the lack of surveillance information for many countries at the beginning of this study, a short survey form (Annex 2) was prepared and sent in mid-October to all known D2 contacts (via European working groups and professional networks) for each European Member State. Responses were received for sixteen countries, for ten of them (including France) survey was the only source of information available for the analyses produced in this report. In the end, only Slovenia did not have any information (HTML report, text, or survey) available for this study.

Table 3 explains the coding of the information used in the synthesis and analysis tables of this report. To illustrate the changes in the revised monitoring programs between the two cycles, the information from the 1st cycle is represented by the colour green and the information from the 2nd cycle by the colour blue. In both cases, the differentiation of information sources was made by shades of tone. In the case where information was reported in both cycles, the colour orange was used and the shade of tone to distinguish between officially reported information (EU reports) and information obtained from our survey. It should be mentioned that cross-referencing information from the reported documents (HTML or EU text) as well as survey responses sometimes showed some inconsistencies. In the few cases where these differences could not be explained by the national contacts, the information in the document notified to the EU was then taken as a reference.

Table 2: dates, type of reporting, and codes of the Member States analysed (NA = not available at 12/12/2020)

Country		GES EU (Art 8)	Art 11			
			EU		Survey	
			Date of the Html report	Date of the text report	Date of the survey	Information
Belgium	BE	15/10/2018	29/10/2020	29/10/2020		
Bulgaria	BG	NA	*NA*	*NA*	28/10/2020	national works still in progress
Croatia	HR	11/12/2019	*NA*	*NA*		
Cyprus	CY	13/05/2020	*NA*	*NA*	26/11/2020	national works still in progress
Denmark	DK	15/10/2019	*NA*	*NA*	21/10/2020	national works still in progress
Estonia	EE	15/10/2019	11/11/2020	11/11/2020	22/10/2020	ready to be reported to the EU
Finland	FI	15/10/2019	03/11/2020	03/11/2020	21/10/2020	national works still in progress
France	FR	15/10/2019	*NA*	*NA*	21/10/2020	national works still in progress
Germany	DE	15/10/2019	14/10/2020	14/10/2020	30/10/2020	
Greece	EL	15/10/2019	*NA*	*NA*	17/11/2020	national works still in progress
Ireland	IE	26/06/2020	*NA*	*NA*	13/11/2020	program under development
Italy	IT	15/10/2019	12/10/2020	12/10/2020	13/10/2020	
Latvia	LV	15/10/2019	*NA*	*NA*	17/11/2020	national works still in progress
Lithuania	LT	09/06/2020	*NA*	*NA*		
Malta	MT	26/06/2020	*NA*	*NA*	09/11/2020	the updates to the monitoring program are still underway
Netherlands	NL	15/10/2018	09/11/2020	09/11/2020		
Poland	PL	15/10/2019	*NA*	*NA*	22/10/2020	2nd cycle monitoring was reported but not available on EIONET. Public consultation document transmitted and used
Portugal	PT	23/03/2020	*NA*	*NA*	21/10/2020	national work in progress, public consultation by end of first quarter 2021
Romania	RO	15/10/2019	*NA*	*NA*	22/10/2020	2nd cycle monitoring reported but not available on EIONET
Slovenia	SI	09/01/2020	*NA*	*NA*		
Spain	ES	15/10/2019	11/12/2020	11/12/2020		
Sweden	SE	15/10/2019	15/10/2020	15/10/2020		
United Kingdom	UK	23/09/2020	*NA*	*NA*	28/10/2020	under public consultations (non disponsible)

Table 3: an explanation of the colour codes used in tables

		not reported	2nd cycle		national report
					survey
1st cycle		national report			national report and survey
		regional report	1st and 2nd cycle		1st cycle report and 2nd cycle survey
		national and regional report			1st and 2nd cycle reports

2 Comparison of D2 GES and monitoring programme reported by the European Member States of the North-East Atlantic regional sea in the 1st and 2nd cycle

2.1 Comparison of GES criteria coverage as reported for the 1st cycle and 2nd cycle

Table 4 compiles the coverage of the old and new GES criteria for Descriptor 2. All countries report covering the new primary criterion D2C1, and only three Member States (Denmark, Spain, and Portugal) also cover both secondary criteria at the upper secondary level. The United Kingdom had not reported any criteria in the 1st cycle, now declared to cover the secondary criterion D2C2 and the new D2C1 criterium. Remarkably, no other Member State reports the secondary criteria in the 2nd cycle, while most had reported similar criteria and/or indicators in the 1st cycle.

Table 4: GES coverage of D2 by the European Member States of the North-East Atlantic (1st cycle and 2nd cycle)

GES 1st cycle		criteria 2.1	indicator 2.1.1	criteria 2.2	indicator 2.2.1	indicator 2.2.2
GES 2ed cycle	criteria D2C1	criteria D2C2		criteria D2C3		
BE	x					
NL	x					
DE	x					
DK	x	x		x		
SE	x					
FR	x					
ES	x	x		x		
IE	x					
PT	x	x		x		
UK						

source of information		
	x	WISE reports 2018
		not reported in any cycle
		reported 2ed cycle
		reported 1st cycle
		reported in both cycles

2.2 Comparison of monitoring programmes as reported for the 1st and 2nd cycle

Information on the monitoring programs of the United Kingdom, France, and Ireland was obtained from a survey, as no official 2nd cycle report was available for these countries at the time of this analysis. Table 5 presents the updated elements monitored by the Member States in their reporting for Descriptor 2. The United Kingdom and Ireland had not reported in the 1st cycle, but each covered several items in the 2nd cycle, according to our survey. Most countries seem to have increased the number of items monitored (blue tones), including "other invertebrates" (other than macrofauna) and zooplankton. Fish (for Belgium and Spain) and phytoplankton (Spain) are no longer reported as monitored under D2 in the 2nd cycle (green tones). All countries continue (orange tones) to monitor macrobenthos and macroalgae in the 2nd cycle (except the Netherlands and Sweden for the last element). Zooplankton and other invertebrates are now followed in the 2nd cycle by most countries, except the Netherlands. Few countries specifically monitor phytoplankton or fish for D2, which seem to be rather opportunistic.

Table 5: elements monitored for D2 by NEA Member States (1st and 2nd cycle)

country	phytoplankton	zooplankton	macrobenthos	macroalgae	fish	invertebrates	notes
BE							sampling on hard substrate
DE							The fish are counted (if they enter a benthic trap) as well as pathogens.
DK							
ES							The 2nd cycle report lists the species to be monitored for 3 sub-programs dedicated to invasive species, aquaculture plants, and within MPAs
FR							Potentially all species except unicellular and microbes
IE							
NL							
PT							
SE							
UK							currently no fish, mammals, or reptiles on the priority NIS

		not reported	2nd cycle		national report
					survey
1st cycle		national report			national report and survey
		regional report	1st and 2nd cycle		1st cycle report and 2nd cycle survey
		national and regional report			1st and 2nd cycle reports

Table 6 illustrates the variety and changes in the parameters monitored between the 1st and 2nd cycles of MSFD implementation. The blue tones (new parameters reported in the 2nd cycle) reflect the variety of titles and units of the reported parameters, rather than actual new parameters. The "presence of NIS" is the most common parameter (except the Netherlands), succeeding "quantity and type of NIS" in the 1st cycle. Parameters related to spatial distribution and abundance (number, coverage, or biomass) are the most common, in both the 1st and 2nd cycles. Other new parameters seem to be more specific to certain countries such as species composition, trends, and impacts, but related to the survey and therefore to be confirmed in future reports. The species ratio and spatial extent of habitat, mentioned in the 1st cycle by some countries, are no longer mentioned in the 2nd cycle. The test of biomolecular techniques, notably environmental DNA, is mentioned by Denmark, Sweden, and France.

Table 6: common parameters monitored for D2 by NEA Member States (1st and 2nd cycle)

country	quantity and type of NIS	species distributional range/ pattern	population size (abundance)	population size (biomass	species ratio	trends	impact	presence of NIS	spatial distribution/extent	species abundance (numbers or cover)	temporal occurrence	species composition of the group	areal extent of habitat	notes
BE														
DE														
DK														traditional vs eDNA
ES														
FR														eDNA NIS detection under testing
IE														
NL														
PT														
SE														Environmental DNA
UK														

		not reported	2nd cycle		national report
					survey
1st cycle		national report			national report and survey
		regional report	1st and 2nd cycle		1st cycle report and 2nd cycle survey
		national and regional report			1st and 2nd cycle reports

The main vectors and pathways of introduction followed by member states are presented in Table 7. A great heterogeneity can be observed between those reported in the 1st or 2nd cycle, both between countries and for the same country (except Spain). Ports and marinas, as risk areas, are still the most mentioned, and to lesser extent aquaculture and aquariums. Fishing and maritime traffic are more rarely reported in the 2nd cycle, to the benefit of ballast water, biofouling, and live bait for a few countries, including France. The strategy of developing a risk-based approach is reflected in the mention of models (Sweden, Ireland), a selection of risk or vulnerable areas (Belgium, Spain, and Sweden), or lists of NIS (United Kingdom). Only the Netherlands no longer reports any dedicated monitoring of pathways and vectors of introduction, justifying this by the low probability of detection of NIS.

Table 7: pathways monitored for D2 by NEA Member States (1st and 2nd cycle)

country	fishing	ship-based transport	harbour/ port/marinas	aquaculture or aquarium	ballast water	hull cleaning/ biofouling	live bait control	vulnerable areas	notes
BE									
DE									
DK									
ES									
FR									NIS on marine litter (candidate protocol to be tested); vulnerable/risk areas = risk analysis to be conducted as a preliminary step to monitoring for D2
IE*									
NL		because of the small chance of NIS discovery […], the Netherlands currently opts for assessment based on the best available knowledge.							
PT									
SE									model of hot spots choosing, citizen science, and eDNA
UK									list of NIS monitored based on data from ongoing biodiversity monitoring (not bespoke to NIS). The list of NIS was chosen to represent key introduction pathways. Some monitoring of ports and marinas under DAERA.

		not reported	2nd cycle		national report
					survey
1st cycle		national report			national report and survey
		regional report	1st and 2nd cycle		1st cycle report and 2nd cycle survey
		national and regional report			1st and 2nd cycle reports

The different marine areas reported for monitoring are listed in Table 8, according to a coast-wide gradient. No information was available for Ireland. Coastal waters, as in the 1st cycle, remain the most monitored sector (except for the Netherlands), followed by transitional waters since the 2nd cycle. Further offshore, territorial waters and the EEZ are mentioned by a few countries, varying according to the cycle considered, including the Netherlands. Only Spain mentions (in the 1st and 2nd cycles) the area beyond the EEZ.

Table 8: areas monitored for D2 by NEA Member States (1st and 2nd cycle)

country	transitional waters	coastal waters	territorial	EEZ	beyond EEZ	notes
BE						
DE						
DK						
ES						The sectors monitored vary by monitoring sub-program D2
FR						marine part = MSFD; terrestrial part = done under NIS national strategy
IE	No information available on specific sectors					
NL						
PT						
SE						
UK						

		not reported	2nd cycle		national report
					survey
1st cycle		national report			national report and survey
		regional report	1st and 2nd cycle		1st cycle report and 2nd cycle survey
		national and regional report			1st and 2nd cycle reports

Table 9 identifies the reported links between national MSFD monitoring standards and other legal or cooperation commitments. Again, there is a great deal of heterogeneity between those reported in the 1st and 2nd cycle, both between countries and within countries. All countries, except Ireland, report a link with OSPAR, as well as, for all countries concerned, with HELCOM (Germany, Denmark, and Sweden) and Barcelona (UNEP-MAP; France and Spain). Links with the WFD, which were numerous in the 1st cycle, are only reported by France, Spain, and Denmark in the 2nd cycle. Links with the recent European regulation on invasive alien species (Council Regulation 1143/2014) and the ratified convention on ballast water and sediment management (BWSC) are the most frequent in the 2nd cycle. Links with other legal texts are rarely if ever, reported in the 2nd cycle. Among these, France reports in particular new links with the WFD, the Bathing Water Directive, and the MSFD, as well as the ongoing implementation of its national strategy on invasive alien species (terrestrial, aquatic, and marine environments).

Table 9: links between the MSFD monitoring standards and other conventions for the NEA Member States (1st and 2nd cycles)

country	WFD	RAMSAR	BWSC	CBD	Habitats Directive	Council Regulation 1143/2014	Council Regulation 708/2007	CFP	Birds Directive	Bathing Water Directive	MSPD	OSPAR	Trilateral Warden Sea Cooperation	UNEP/MAP	HELCOM	notes
BE																
DE																
DK																
ES																
FR																National Strategy under implementation
IE																
NL																
PT																
SE																
UK																NIS priority list and the specific NIS monitored

		not reported	2nd cycle		national report
					survey
1st cycle		national report			national report and survey
		regional report	1st and 2nd cycle		1st cycle report and 2nd cycle survey
		national and regional report			1st and 2nd cycle reports

3 Comparison of D2 GES and monitoring programme reported by the European Member States of the Mediterranean Sea for the 1st and the 2nd cycle

3.1 Comparison of GES criteria coverage as reported for the 1st cycle and 2nd cycle

As for the Atlantic, all Mediterranean Member States have unanimously declared to cover the new primary criterion D2C1 for their revised GES 2nd cycle (Table 10) and despite almost unanimity in the 1st cycle, only a few countries report to cover the secondary criteria D2C2 (Cyprus, Spain, Croatia, and Malta) and D2C3 (Spain and Malta) in the 2nd cycle.

Table 10: coverage of GES reported for D2 by National Report of Mediterranean Member States (1st and 2nd cycle)

GES 1st cycle		criteria 2.1	indicator 2.1.1	criteria 2.2	indicator 2.2.1	indicator 2.2.2
GES 2ed cycle	criteria D2C1	criteria D2C2		criteria D2C3		
CY						
EL						
ES	x	x		x		
FR	x					
HR	x					
IT	x					
MT	x	x				
SI						
UK[2]						

source of information		
	x	WISE reports 2018
		not reported in any cycle
		reported 2ed cycle
		reported 1st cycle
		reported in both cycles

[2] pour Gibraltar

3.2 Comparison of monitoring programmes as reported for the 1st and 2nd cycle

Table 11 summarises the elements of D2 monitoring reported by each Mediterranean Member State. No information was available for Slovenia, neither in the 1st nor in the 2nd cycle. Information for the United Kingdom was obtained from the survey carried out for this report, without distinction between the North-East Atlantic and the Mediterranean (for the territory of Gibraltar, but non-Contracting Party to the Barcelona Convention). Only Greece (EL) has not modified - neither added nor deleted - the elements reported between the 1st and 2nd cycle. Cyprus, France, and the United Kingdom have added some, while the remaining countries have deleted some elements. As in the Atlantic, in the 2nd cycle, all the countries follow macrobenthos (and other invertebrates) and macroalgae (except Croatia for last).
Zooplankton is now monitored by all countries except Greece and Croatia (HR). Few countries specifically monitor phytoplankton or fish for D2, which seem to be rather opportunistic.

Table 11: elements monitored for D2 by National Report of Mediterranean Member States (1st and 2nd cycle)

country	phytoplankton	zooplankton	macrobenthos	macroalgae	fish	invertebrates	mammals	notes
CY								
EL								
FR								Potentially all species except unicellular and microbes.
ES								The 2nd cycle report lists the species to be monitored for 3 sub-programmes dedicated to invasive species, aquaculture plants, and within MPAs
HR								Mainly benthic species. Non-dedicated planktonic species, in the context of pelagic habitats.
IT								
MT								
SI*	no report in 1st and 2nd cycle							
UK[2]								there are currently no fish, mammals, or reptiles on the priority NIS list for D2

		not reported	2nd cycle		national report
					survey
1st cycle		national report			national report and survey
		regional report	1st and 2nd cycle		1st cycle report and 2nd cycle survey
		national and regional report			1st and 2nd cycle reports

[2] pour Gibraltar

Table 12 illustrates, as, in the Atlantic, the variety and changes in the parameters monitored between the 1st and 2nd cycles of the MSFD implementation, concerning the diversity of headings and units reported by all countries. The "presence of NIS" is the parameter common to all Member States. Parameters related to spatial distribution and abundance (number, coverage, or biomass) are then the most common, both in the 1st and 2nd cycles. Temporal occurrences and trends are reported by several countries. Species ratio and impacts, mentioned in the 1st cycle by some countries, are no longer mentioned in the 2nd cycle.

Table 12: common parameters monitored for D2 by National Report of Mediterranean Member States (1st and 2nd cycle)

country	quantity and type of NIS	species distributional range/ pattern	population size (abundance)	population size (biomass)	species ratio	trends	impact	presence of NIS	spatial distribution/extent	species abundance (numbers or cover)	temporal occurrence	species composition of the group	notes
CY													Risk Assessment Reports DFMR Tender 26/2016 of the Republic of Cyprus and risks analysis under LIFE project Re-LionMed.
EL													
ES													
FR													eDNA under testing for presence detection of targeted species.
HR													
IT													
MT													
SI*	no report in 1st and 2nd cycle												
UK[2]													

		not reported	2nd cycle		national report
					survey
1st cycle		national report			national report and survey
		regional report	1st and 2nd cycle		1st cycle report and 2nd cycle survey
		national and regional report			1st and 2nd cycle reports

[2] pour Gibraltar

The important changes (blue tones) and especially reduction (green tones) in the types of pathways and vectors monitored between the two MSFD cycles are visible in Table 13. Ports and marinas, as risk areas, remain the most monitored (except for Cyprus, which abandoned it in the 2nd cycle in favour of fisheries), followed by aquaculture and aquaria (except for Greece and Croatia). France is the country that reports the most pathways followed (all those mentioned, except fishing and maritime traffic) and the only one to report ballast water, biofouling and lives bait. The strategy of developing a risk-based approach is also reflected in the mention of vulnerable areas by several countries.

Table 13: pathways monitored for D2 by National Report of Mediterranean Member States (1st and 2nd cycle)

country	fishing	ship-based transport	harbour/ port/marinas	aquaculture or aquarium	ballast water	hull cleaning/ biofouling	live bait control	vulnerable areas	notes
CY									
EL									https://elnais.hcmr.gr/, just started monitoring harbour/port/marinas
ES									
FR									NIS on marine litter (candidate protocol to be tested); vulnerable/risk areas = risk analysis to be conducted as a preliminary step to monitoring for D2
HR									
IT									
SI*	no report in 1st and 2nd cycle								
UK[2]									

		not reported	2nd cycle		national report
1st cycle		national report			survey
		regional report	1st and 2nd cycle		national report and survey
		national and regional report			1st cycle report and 2nd cycle survey
					1st and 2nd cycle reports

[2] pour Gibraltar

Table 14 illustrates the increase (blue tones) in the reported spatial coverage of monitoring programmes between the two MSFD cycles. Only France and Spain mention transition waters. Coastal waters, as in the 1st cycle, remain the most monitored sector. All countries, except Cyprus and France, reported monitoring their territorial waters. Offshore surveillance is cited by Greece, Spain, Croatia and Gibraltar for their respective EEZ. Spain reports monitoring all sectors, including beyond its EEZ, but the sectors monitored differ between the five established monitoring sub-programmes.

Table 14: areas monitored for D2 by National Report of Mediterranean Member States (1st and 2nd cycle)

country	transitional waters	coastal waters	territorial	EEZ	beyond EEZ	notes
CY						
EL						
ES						
FR						
HR						
IT						
MT						
SI*	no report in 1st and 2nd cycle					
UK[2]						

	not reported	2nd cycle		national report
				survey
1st cycle		national report		national report and survey
		regional report	1st and 2nd cycle	1st cycle report and 2nd cycle survey
		national and regional report		1st and 2nd cycle reports

[2] pour Gibraltar

Table 15 shows again a strong heterogeneity (green and blue tones) between the reports of each round, both between countries and within countries. Links with the WFD remain the most frequent with 5 countries (Cyprus, Spain, France, Croatia, Malta), but on an equal footing in the 2nd cycle with the Barcelona Convention (Spain, France, Malta, joined by Cyprus and Italy). OSPAR is now cited by the two countries concerned (Spain and France). The links with the recent European regulations on invasive alien species (Council Regulation 1143/2014) and the ratified convention on ballast water and sediment management (BWSC) are now reported only by France, and by Italy and Spain for the latter. Links with other legal texts are only rarely if at all, reported in the 2nd cycle. Of these, France reports the most links (five added to the two from the 1st cycle), including new links with the Bathing Water Directive and the Maritime Spatial Planning Directive. Apart from the lack of information for Slovenia, Greece and the United Kingdom no longer report any links with other legal texts.

Table 15 links between MSFD surveillance standards and other conventions for European Mediterranean Member States (1st and 2nd rounds)

	WFD	RAMSAR	BWSC	CBD	Habitats Directive	Council Regulation 1143/2014	Council Regulation 708/2007	CFP	Bird Directive	Bathing Water Directive	MSPD	DCF	OSPAR	MedITS	UNEP/MAP	HELCOM	notes
CY																	
EL*																	
ES																	
FR																	national strategy under implementation
HR																	
IT																	
MT																	
SI*	No information, neither in the 1st nor in the 2nd cycle																
UK[2]*																	a priority list of specific NIS monitored

	not reported	2nd cycle		national report
				survey
1st cycle		national report		national report and survey
		regional report	1st and 2nd cycle	1st cycle report and 2nd cycle survey
		national and regional report		1st and 2nd cycle reports

[2] pour Gibraltar

4 Comparison of D2 GES and monitoring programme reported by the European Member States of the Baltic Sea for the 1st and 2nd cycle

4.1 Comparison of GES criteria coverage as reported for the 1st and 2nd cycle

As for the Atlantic and the Mediterranean, all Baltic Member States have unanimously declared to cover the new primary criterion D2C1 for their revised 2nd cycle GES (Table 16) and, despite almost unanimity in the 1st cycle, only a few countries report to cover secondary criteria D2C2 and D2C3 in the 2nd cycle (Estonia, Lithuania, Denmark and Poland for the last).

Table 16: coverage of GES for D2 reported by Baltic Sea Member States and France (1st and 2nd cycle)

GES 1st cycle		criteria 2.1	indicator 2.1.1	criteria 2.2	indicator 2.2.1	indicator 2.2.2
GES 2ed cycle	criteria D2C1	criteria D2C2		criteria D2C3		
EE	x	x				
LV						
LT	x	x		x		
DE	x					
DK	x	x		x		
SE	x					
FI	x					
PL	x	x				
FR	*x*					

source of information		
	x	WISE reports 2018
		not reported in any cycle
		reported 2ed cycle
		reported 1st cycle
		reported in both cycles

4.2 Comparison of monitoring programmes as reported for the 1st and 2nd cycle

Table 17 summarises the elements of D2 monitoring reported by each Baltic Sea Member State. National reports for the 2nd cycle were available, except for Latvia and Poland. For Poland, the information was obtained from the survey and the ongoing public consultation file. All countries reported monitoring macrobenthos, zooplankton and phytoplankton. Macroalgae are monitored by all except Lithuania, Latvia and Sweden. Fish and other invertebrates are monitored by the majority of countries.

Table 17: elements monitored for D2 by Baltic Sea Member States and comparison with France (1st and 2nd cycle)

country	phytoplankton	zooplankton	macrobenthos	macroalgae	fish	invertebrates	notes
DE							The fish are counted (if they enter a benthic trap) as well as pathogens.
DK							
EE							
FI							
LT							
LV							mobile epifauna, fouling organisms
PL							
SE							
FR_{NEA}							*species except for unicellular and microbials*
FR_{MED}							

		not reported	2nd cycle		national report
					survey
1st cycle		national report			national report and survey
		regional report	1st and 2nd cycle		1st cycle report and 2nd cycle survey
		national and regional report			1st and 2nd cycle reports

Table 18 illustrates, as, in the Atlantic and Mediterranean, the variety and changes in the parameters monitored between the 1st and 2nd MSFD implementation cycles, concerning the diversity of titles reported by all countries. The "presence of NIS" is once again the parameter common to all Member States. Parameters related to spatial distribution and abundance (numbers, coverage or biomass) are then the most common, in both the 1st and 2nd cycles. The "species composition of the group" is reported by several countries. Temporal occurrences, trends and impacts are in the minority. The species ratio is not mentioned in either the 1st or 2nd cycle.

Table 18: common parameters monitored for D2 by Baltic Sea Member States and comparison with France (1st and 2nd cycle)

country	quantity and type of NIS	species distributional range/ pattern	population size (abundance)	population size (biomass)	species ratio	trends	impact	presence of NIS	spatial distribution/extent	species abundance (numbers or cover)	temporal occurrence	species composition of the group	notes
DE													
DK													traditional vs eDNA based methods
EE													
FI													
LT													bio-pollution index
LV													
PL													
SE													
FR_{Nea}													*eDNA under testing for presence detection of targeted species.*
FR_{Med}													

		not reported	2nd cycle		national report
					survey
1st cycle		national report			national report and survey
		regional report	1st and 2nd cycle		1st cycle report and 2nd cycle survey
		national and regional report			1st and 2nd cycle reports

Table 19 reflects the changes in the types of pathways and vectors monitored between the two MSFD cycles. Ports and marinas remain the most monitored track (except for Lithuania, and Sweden which abandoned it in the 2nd cycle), followed by ballast water, but only for Germany, Estonia, and Poland. Other pathways and vectors are little reported, if at all, for biofouling and live bait.

Table 19: pathways monitored for D2 by Baltic Sea Member States and comparison with France (1st and 2nd cycle)

country	fishing	ship-based transport	harbour/ port/marinas	aquaculture or aquarium	ballast water	hull cleaning/ biofouling	live bait control	vulnerable areas	notes
DE									
DK									
EE									ballast waters are monitored within research projects
FI									
LT*									
LV									
PL[1]									
SE									model of hot spots choosing, citizen science and eDNA
FR$_{Nea}$									*NIS on marine litter (candidate protocol to be tested); vulnerable/risk areas = risk analysis to be conducted as a preliminary step to monitoring for D2*
FR$_{Med}$									

		not reported	2nd cycle		national report
					survey
1st cycle		national report			national report and survey
		regional report	1st and 2nd cycle		1st cycle report and 2nd cycle survey
		national and regional report			1st and 2nd cycle reports

Table 20 illustrates the overall increase (blue tones) in the spatial coverage of monitoring programmes reported between the two cycles, except for Sweden. All countries now monitor their coastal waters. The great majority also monitor transitional waters (except Sweden and Estonia), territorial waters (except Sweden and Poland) and EEZ (except Sweden and Latvia). No country no longer monitors beyond its EEZ.

Table 20: areas monitored for D2 by Baltic Sea Member States and comparison with France (1st and 2nd cycle)

country	transitional waters	coastal waters	territorial	EEZ	beyond EEZ	notes
DE						
DK						
EE						
FI						
LT						
LV						
PL[1]						
SE						
FR$_{Nea}$						*Marine part = MSFD; Terrestrial part = done under terrestrial part of the national strategy.*
FR$_{Med}$						

		not reported	2nd cycle		national report
1st cycle		national report			survey
		regional report	1st and 2nd cycle		national report and survey
		national and regional report			1st cycle report and 2nd cycle survey
					1st and 2nd cycle reports

Table 21 shows again a strong heterogeneity (green and blue tones) between the reports of each round on the links with other legal texts, both between countries and within countries. The link with HELCOM is almost unanimous (except for Poland), as well as with OSPAR for the countries concerned (Germany, Denmark, Finland, and Sweden), then with the WFD (except for Germany and Latvia in the 2nd cycle). Several countries also mention the links with the recent European regulations on invasive alien species (Council Regulation 1143/2014) and the ratified convention on ballast water and sediment management (BWSC). Links with other legal texts are only rarely if at all, reported in the 2nd cycle.

Table 21: links between MSFD monitoring standards and other conventions for European Baltic Sea Member States, and comparison with France (1st and 2nd cycle)

	WFD	RAMSAR	BWSC	CBD	Habitats Directive	Council Regulation 1143/2014	Council Regulation 708/2007	CFP	Birds Directive	Bathing Water Directive	MSPD	DCF	OSPAR	Trilateral Warden Sea Cooperation	UNEP/MAP	HELCOM	notes
DE																	
DK																	
EE																	
FI																	
LT																	
LV																	
PL																	
SE																	
FR_{Nea}																	
FR_{Med}																	

		not reported	2nd cycle		national report
					survey
1st cycle		national report			national report and survey
		regional report	1st and 2nd cycle		1st cycle report and 2nd cycle survey
		national and regional report			1st and 2nd cycle reports

5 Comparison of D2 GES and monitoring programme reported by the European Member States of the Black Sea for the 1st and 2nd cycle

5.1 Comparison of GES criteria coverage as reported for the 1st and 2nd cycle

The official Bulgarian report on monitoring programmes was not available. All information was obtained through our survey sent to national experts. After having reported covering all GES criteria and indicators in the 1st cycle, Bulgaria would not report any criteria in the 2nd cycle MSFD, according to our survey (Table 22). Conversely, Romania, which had not defined a GES in the 1st cycle, reports, in its National Report, covering all GES criteria (primary and secondary).

Table 22: GES coverage for D2 by European Black Sea Member States and France (1st and 2nd cycle)

GES 1st cycle		criteria 2.1	indicator 2.1.1	criteria 2.2	indicator 2.2.1	indicator 2.2.2
GES 2ed cycle	criteria D2C1	criteria D2C2		criteria D2C3		
BG						
RO	x	x		x		
FR	*x*					

source of information	x	WISE reports 2018
		not reported in any cycle
		reported 2ed cycle
		reported 1st cycle
		reported in both cycles

5.2 Comparison of monitoring programmes as reported in 1st and 2nd cycle

Romania reported one monitoring programme dedicated to Descriptor 2 and five programmes in which this descriptor was also considered. In contrast to the trends in other regional seas, both countries report monitoring fewer items than in the first cycle (Table 23), by abandoning monitoring of macrobenthos, macroalgae and fish. Bulgaria plans to study phytoplankton, zooplankton, and invertebrates, while Romania focuses on zooplankton communities.

Table 23: elements monitored for D2 by Black Sea Member States and comparison with France (1st and 2nd cycle)

country	phytoplankton	zooplankton	macrobenthos	macroalgae	fish	invertebrates	mammals	notes
BG								
RO								
FR_{Nea}								
FR_{Med}								*species except for unicellular and microbes*

		not reported	2nd cycle		national report
1st cycle		national report			survey
		regional report	1st and 2nd cycle		national report and survey
		national and regional report			1st cycle report and 2nd cycle survey
					1st and 2nd cycle reports

Table 24 shows the significant changes (no orange tones) in the parameters reported by these two countries. Bulgaria reports two parameters ("presence of NIS" and "spatial distribution/extent"). Romania follows four parameters ("presence of NIS", "biomass (population)", "trends" and "impacts"), related to the use of the biopollution index. Only the presence of NIS (and trends) is in common with France, which follows more parameters.

Table 24: common parameters monitored for D2 by Black Sea Member States and France (1st and 2nd cycle)

country	quantity and type of NIS	species distributional range/ pattern	population size (abundance)	population size (biomass)	species ratio	trends	impact	presence of NIS	spatial distribution/extent	species abundance (numbers or cover)	temporal occurrence	species composition of the group	notes
BG													
RO													Biopolution index
FR_{Nea}													*eDNA under testing for detection of targeted species*
FR_{Med}													

		not reported	2nd cycle		national report
1st cycle		national report			survey
		regional report			national report and survey
		national and regional report	1st and 2nd cycle		1st cycle report and 2nd cycle survey
					1st and 2nd cycle reports

Bulgaria continues in the 2nd round to monitor ports and marinas, adding maritime/pleasure traffic (Table 25). Romania no longer reports any particular pathway or vector, but only now the identification of risk and vulnerable areas.

Table 25: pathways monitored for D2 by Black Sea Member States and comparison with France (1st and 2nd cycle)

country	fishing	ship-based transport	harbour/ port/marinas	aquaculture or aquarium	ballast water	hull cleaning/ biofouling	live bait control	vulnerable areas	notes
BG									
RO									hot spots areas
FR_{Nea}									*NIS on marine litter (candidate protocol to be tested); vulnerable/risk areas = risk analysis to be conducted as a preliminary step to monitoring for D2*
FR_{Med}									

		not reported	2nd cycle		national report
1st cycle		national report			survey
		regional report			national report and survey
		national and regional report	1st and 2nd cycle		1st cycle report and 2nd cycle survey
					1st and 2nd cycle reports

As for the majority of the European Member States, Bulgaria and Romania report monitoring their coastal waters, plus transitional and territorial waters for Romania, while Bulgaria only mentions its EEZ and beyond (Table 26).

Table 26: areas monitored for D2 by Black Sea Member States and comparison with France (1st and 2nd cycle)

country	transitional waters	coastal waters	territorial	EEZ	beyond EEZ	notes
BG						
RO						
FR_{Nea}						*marine part = MSFD; terrestrial part = done under terrestrial part of the national strategy.*
FR_{Med}						

		not reported	2nd cycle		national report
					survey
1st cycle		national report			national report and survey
		regional report	1st and 2nd cycle		1st cycle report and 2nd cycle survey
		national and regional report			1st and 2nd cycle reports

Table 27 again shows large differences between the reports from Bulgaria and Romania on the relationship with other legal texts. Contrary to the trends in other regional seas, the link with the Bucharest Convention is no longer directly reported in the 2nd cycle, but each country mentions the Convention for the Protection of the Black Sea Marine Environment from Pollution (BSIMAP) and the Black Sea Strategic Action Plan (BS-SAP). Habitats Directive is reported by both countries. No other links are common between the two countries. Only the WFD and the Ballast Water and Sediments Convention (BWSC) are common between France and Bulgaria.

Table 27: links between DCSMM monitoring standards and other conventions for European Black Sea Member States, and comparison with France (1st and 2nd cycle)

country	WFD	RAMSAR	BWSC	CBD	Habitats Directive	Council Regulation 1143/2014	Council Regulation 708/2007	CPF	Birds directive	Bathing Water Directive	MSPD	CFP	DCF	OSPAR	Bucharest Convention	UNEP/MAP	HELCOM	notes
BG																		BSIMAP BS-SAP
RO																		BSIMAP BS-SAP
FR_{Nea}																		
FR_{Med}																		

		not reported	2nd cycle		national report
					survey
1st cycle		national report			national report and survey
		regional report	1st and 2nd cycle		1st cycle report and 2nd cycle survey
		national and regional report			1st and 2nd cycle reports

6 Overview of GES and D2 monitoring programmes reported by the European Member States in the 2nd cycle

Despite the 2nd cycle reports still under development or very recent, information on the monitoring programmes of almost all European Member States could be obtained and synthesised in this study. The only country for which no information was available was Slovenia. Table 28 summarises the status of the revision of the D2 monitoring programmes for the 2nd cycle. Of the 23 Member States, eleven countries have reported and made their national reports available. Two other countries reported but their report was not available at the time of this study. Finally, nine countries had not yet reported for the 2nd cycle. The survey conducted for this study among the national contacts, however, made it possible to obtain these elements from the 2nd cycle to carry out this analysis in a quasi-exhaustive and unprecedented way.

Table 28: status of revised monitoring programmes 2nd cycle for Descriptor 2, at 12/12/2020

BE	BG	CY	DE	DK	EE	EL	ES	FI	FR	HR	IE	IT	LT	LV	MT	NL	PL	PT	RO	SE	SI	UK
RA	D	R	**RA**	**RA**	**RA**	D	**RA**	D	D	**RA**	D	**RA**	**RA**	D	D	**RA**	R	D	**RA**	**RA**		PC

D - under development, PC – public consultations, R – reported but unrealised, RA – reported and available

6.1 GES covering

Apart from Bulgaria, it is remarkable that all the other 21 European Member States report to cover the new GES primary criterion D2C1 (newly introduced species). Criterion D2C2 (abundance and distribution of established species) is now reported by only 11 countries (Denmark, Spain, Portugal, UK, Croatia, Cyprus, Malta, Estonia, Lithuania, Poland, and Romania). Criterion D2C3 (proportions of species and habitats adversely affected by NIS) is now reported by only 7 countries (Denmark, Spain, Portugal, Malta, Estonia, Lithuania, and Romania).

6.2 Monitored elements

Among the 22 European Member States for which this information was available, most of the countries emphasise that the dedicated monitoring programme for Descriptor 2 will be linked to the dedicated monitoring of other descriptors, particularly biodiversity. The information obtained by these different sub-programmes will therefore all be able to provide information on new species introductions (primary criterion D2C1). Depending on the country, the elements declared as monitored here (Table 29) may therefore be monitored via other monitoring sub-programmes. Macrobenthos is the most common element in the 2nd cycle (20/22), followed by other invertebrates (18/22) and macroalgae (15/22), mainly in the Atlantic and Mediterranean. Monitoring of zooplankton (18/20) then phytoplankton (15/21) is essentially frequent and common in the Baltic and the Black Sea. Fish are mentioned several times (14/21), but mainly in the Baltic.

Table 29: elements monitored in the 2nd cycle and number of corresponding Member States, out of the 22 for which information was available

	phytoplankton	zooplankton	macrobenthos	macroalgae	fish	invertebrates
Atlantic (10)	6	8	10	8	6	9
Mediterranean (8)	4	6	8	7	3	8
Baltic Sea (8)	8	8	8	5	7	6
Black Sea (2)	1	2	0	0	0	0
Total EU (22)	**15**	**18**	**20**	**15**	**14**	**18**

6.3 Monitored parameters

Of the 22 Member States for which information was available (Table 30), there is almost unanimity on the parameter "presence of NIS" (21/22). Only the Netherlands does not report it. The most common parameters, regardless of the cycle considered, are those related to spatial distribution and abundance/biomass. Other parameters are rarer, especially impacts (4/21), or even more rarely reported (species ratio: 0/22).

Table 30: parameters monitored in the 2nd cycle and the number of corresponding Member States, among the 22 for which information was available.

	quantity and type of NIS	species distributional range/ pattern	population size (abundance)	population size (biomass)	species ratio	trends	impact	presence of NIS	spatial distribution / extent	abundance (number or cover)	temporal occurrence	species composition of group
Atlantic (10)	5	3	2	4	0	3	1	9	5	4	4	2
Mediterranean (8)	5	4	2	2	0	3	0	8	5	6	6	2
Baltic Sea (8)	2	1	4	5	0	2	2	8	6	6	2	4
Black Sea (2)	0	0	0	0	0	1	1	2	1	0	0	0
Total EU (22)	**10**	**7**	**7**	**10**	**0**	**6**	**4**	**21**	**14**	**13**	**10**	**5**

6.4 Monitored pathways, vectors, and risk areas

Of the 21 Member States for which information was available (excluding the Netherlands; Table 7), the most frequent parameter remains ports and marinas (15/21) as in the 1st cycle (Table 31). The other pathway and vectors are more rarely cited, whatever the marine region considered, in favour of a more general "risk approach" in the 2nd cycle (risk and/or vulnerable areas), which is often cited but for which few details were available.

Table 31: pathways, vectors and risk areas monitored in the 2nd cycle and the number of corresponding Member States among the 21 for which information was available.

	fishing	ship-based transport	harbour/ port/marinas	aquaculture or aquarium	ballast water	hull cleaning/ biofouling	live bait control	vulnerable areas
Atlantic (9)	1	1	6	3	2	1	2	4
Mediterranean (8)	2	1	5	3	2	1	2	4
Baltic Sea (8)	1	2	6	1	3	0	0	2
Black Sea (2)	0	1	1	0	0	0	0	1
Total EU (21)	**4**	**5**	**15**	**6**	**4**	**1**	**1**	**6**

6.5 Monitoring areas

Of the 21 Member States for which information was available (Table 32), there is almost unanimity on the parameter "coastal waters" (21/22). Only Ireland does not report any sectors, referring to a risk-based approach (Table 8). Territorial waters and the exclusive economic zone (EEZ) are the next most frequent sectors (13/21 each), particularly in the Mediterranean and the Baltic. Transitional waters (10/21) are mentioned mostly only in the Atlantic and Baltic. Only Spain reports surveillance beyond its EEZ.

Table 32: zones monitored in the 2nd cycle and corresponding number of Member States among the 21 for which information was available

	transitional waters	coastal waters	territorial	EEZ	beyond EEZ
Atlantic (9)	5	8	3	6	1
Mediterranean (8)	2	8	5	4	1
Baltic Sea (8)	6	8	6	6	0
Black Sea (2)	1	2	1	1	1
Total EU (21)	**10**	**20**	**13**	**13**	**1**

6.6 Links between MSFD monitoring standards and other conventions and standards

In general, the 22 European Member States reported fewer links in the 2nd cycle than in the 1st cycle, with the notable exception of France. The WFD remains the majority link (12/21; Table 33). Contrary to the 1st cycle, it is remarkable to observe that almost all Member States now report the link with the regional seas convention(s) to which it is a Contracting Party. The Ballast Water and Sediments Convention (BWSC) and invasive alien species regulation (Council Regulation 1143/2014) are the next most frequently cited links (9 and 8/21 respectively). The habitat Directive is now only mentioned by Germany, Cyprus, Estonia, Bulgaria, and Romania. All other links are not mentioned by more than 2 countries, if at all. Greece and Ireland no longer report any links in the 2nd cycle.

Table 33: legal links 2nd cycle and the number of corresponding Member States among the 22 for which information was available. CPs = Contracting Parties to the Regional Seas Conventions, which are here also the European Member States.

	WFD	RAMSAR	BWSC	CBD	Habitats Directive	Council Regulation 1143/2014	Council Regulation 708/2007	CFP	Birds Directive (79/409/CEE)	Bathing Water Directive (2006/7/CE)	MSPD	DCF	OSPAR (10 CPs)	UNEP/MAP (9 CPs)	HELCOM (8 CPs)	Bucharest Convention + BSIMAP et BS-SAP (2 CPs)
Atlantic (10)	4	0	4	1	1	5	0	0	0	1	2	0	8	2	3	0
Mediterranean (8)	5	0	1	0	1	3	1	1	0	1	1	1	2	5	0	0
Baltic Sea (8)	6	0	5	0	2	4	0	0	0	0	1	0	5	0	7	0
Black Sea (2)	1	0	1	1	2	0	0	1	0	0	0	1	0	0	0	2
Total EU (22) or RSC	**12**	**0**	**9**	**2**	**5**	**8**	**1**	**2**	**0**	**1**	**2**	**2**	**10**	**5**	**7**	**2**

7 Conclusions and prospects

In contrast to the review of the reporting elements of the 1st cycle (Lizińska and Guérin, 2020), only the definitions of the Good Environmental Status (GES) of the 2nd cycle were available at the beginning of this study (autumn 2020). A survey was therefore designed (Annex 1) and conducted to obtain the status and reporting elements of the revised 2nd cycle monitoring programmes of the European Member States. The first official 2nd cycle D2 monitoring reports then began to be available at the end of 2020, which made it possible to strengthen and compare the information collected. The national reports and the survey of national experts carried out for this study have therefore made it possible to compare and analyse the GES and 2nd cycle monitoring revisions in an almost complete (except for Slovenia) and unprecedented way. Future analyses of these reports by the European Commission, under article 12 MSFD, may confirm, contradict or clarify the conclusions made here, in particular with a specific comparison with the French elements, still under development at the time of this report (public consultation and reporting foresaw in 2021).

These conclusions and interpretations at the different geographical scales are intended to shed light on and guide the national work concerning the changes observed between the 1st and 2nd MSFD cycles.

<u>Conclusions on comparisons and analyses at the level of MSFD cycles, revised GES elements and D2 monitoring, between countries, regional seas and within the European Union:</u>

- The new primary GES criterion D2C1 (newly introduced species) is reported by all the European Member States (except Bulgaria). This near unanimity could be explained by the primary (mandatory) character of this criterion in the 2nd cycle, but probably also by the strengthened links with the standards of the Regional Seas Conventions (see below on legal links), whose common indicators are linked to trends in new introductions. Criteria D2C2 and D2C3 are respectively less and under-reported, which could be related to their secondary nature, the lack of operational indicators for these aspects in the Regional Seas Conventions, and more probably by the lack of dedicated monitoring, and the gaps in opportunistic data on the distribution, abundance and impacts of most non-indigenous marine species.
- More country-specific monitoring is generally reported in the 2nd cycle, but with a mix of dedicated D2 monitoring and other opportunistic monitoring or data. While macrobenthos (and other invertebrates) and zooplankton are common to almost all of them, the disparities between countries and between regional seas probably partly reflect biogeographic specificities at these two scales, as well as cultural specificities, or those linked to the history of existing monitoring (notably the WFD and regional seas conventions). Monitoring of macroalgae is thus frequent in the Atlantic and Mediterranean, whereas monitoring of phytoplankton is primarily carried out in the Baltic and Black Seas. Fish are mentioned several times, mainly in the Baltic, but often in connection with other monitoring or via opportunistic data.
- The parameter "presence of NIS", reported by almost all countries, logically reflects the minimum required to fill in the primary criterion D2C1 (newly introduced species). For the other parameters, the strong heterogeneity observed between the 1st and 2nd cycles seems mainly linked to the differences in the titles of the parameters reported. The distribution and abundance of NIS, the most frequent parameters afterwards, can be linked to the former 1st cycle criterion 2.1 (trends in abundance and distribution of NIS) and the new criterion D2C2 (abundance and spatial distribution of NIS), with its associated gaps in knowledge and existing monitoring. More reason perhaps to explain the scarcity of the "impacts" parameter, linked to criterion D2C3, which requires the development of assessment methods integrated with species and habitats (and Descriptor 1, biodiversity). New monitoring methods (particularly biomolecular) are mentioned in the comments, but generally seem to be still being tested or too preliminary to be reported as a standard element in the 2nd cycle.
- It is generally a decrease in the number of pathways and vectors and risk areas monitored that is noted between the two cycles, even if ports and marinas remain in the majority. This can be linked to the reporting of the monitoring of risk and/or vulnerable areas, and the mention of a risk-based approach

being developed (notably by Ireland, the United Kingdom, the Netherlands, France, Sweden, Cyprus and Greece).

- As in the first cycle, most of the countries report monitoring in coastal waters, which seems relevant because of this biological pressure. Territorial waters and the EEZ are then more frequent in the Mediterranean and the Baltic, whereas the Atlantic countries favour transition waters first. It would be interesting to study in more detail what offshore monitoring consists of, and whether it is linked to monitoring on a larger scale (e.g., fishing campaigns or other scientific observations). Similarly, it would be interesting to study in more detail whether the monitoring reported in transitional waters, a very relevant sector and also highly subject to this biological pressure, corresponds to more local initiatives or the reporting of monitoring carried out in the framework of other regulations (e.g., WFD, Ballast Water and Sediments Convention, Council Regulation 1143/2014 or others).
- The previous point also underlines and probably underlines the varying interpretations observed here between countries and regional seas, both in terms of their links with other regulations (European, regional or local), and in terms of the operationality of the implementation of dedicated NIS monitoring.
- Another important development noted in this study, compared to the first cycle and to be linked to those described above, is the almost systematic linkage of the reported MSFD NIS follow-ups (and all its elements) with the Regional Seas Conventions (specific to each country). This could be linked, in both directions, to the development of indicators for the D2C1 criterion-based essentially on the parameter "the presence of NIS". The few other legal links remaining frequent, but less than in the 1st cycle, are the WFD, then the Ballast Water and Sediments Convention, and Council Regulation 1143/2014. The maintenance of these legal links, compared to the other regulations, could be due to the constraints of results linked to these texts, concerning the NIS biological pressure.

Conclusions on French specificities and recommendations:

France shows both similar and specific developments in comparison with the other Member States, as well as with trends at regional sea level, which are detailed in the previous tables and paragraphs. The main aspects of these points of convergence and divergence are:

- The adoption of criterion D2C1 - and the corresponding OSPAR indicator (NIS3) - in the revised definition of the French GES in the 2nd cycle is consistent with all Member States and with the OSPAR Convention. It will be necessary to ensure, through French involvement in the dedicated work, that the similar but less developed indicator in the Barcelona Convention is as compatible as possible with this NIS3 indicator. It will also be important to monitor, again via the dedicated working groups, and analyse in detail the reporting for the D2C2 and D2C3 criteria made by several countries, and their potential equivalents in the Regional Seas Conventions, to verify and/or advocate the French approach being developed for these criteria and the associated monitoring (two D2C2 indicators and two D2C3 indicators related to species and habitats; Massé and Guérin, 2018).
- The monitoring reported by France in the 2nd cycle of macrobenthos (and other invertebrates), macroalgae and zooplankton are consistent and compatible with the common core of the Atlantic and Mediterranean Member States. It will be important that the methods and groups of species monitored are also compatible with the standards of other countries and regional seas conventions, particularly through French involvement in the working groups of the Regional Seas Conventions and the International Council for the Exploration of the Sea on these issues.
- Again, the most common parameters at European and regional seas level are now reported by France, although monitoring and indicators, particularly those associated with spatial distribution, abundance and therefore trends, are still being developed. It will be important to ensure that these parameters and the corresponding data are acquired (sampling strategy and protocols) in a way that is compatible with the standards of other countries and regional seas conventions, particularly for protocols associated with new biomolecular methods.
- France reports in the 2nd cycle the monitoring of several risk areas, while many countries have reduced the number of such areas. As indicated by several countries, including France, it is essential to conduct a risk analysis to identify risk and/or vulnerable areas concerning the main vectors (see Massé and Guérin, 2020). These risks and areas may be different and variable from one country to another, which could

explain the variability observed. All the pathways and vectors identified here remain important sources to consider, particularly in France where these pathways, vectors and risk zones are numerous and extensive. The risk analysis methods and models to be used in France will have to be concerted and compared with those of neighbouring countries, as will innovative monitoring (marine waste).

- France's monitoring of transitional and coastal waters reflects the area's most at risk and most observed, in line with the other Member States, particularly in the Atlantic and Baltic. To cover all its responsibilities and MSFD objectives, and to be consistent with the Member States in the Mediterranean (and incidentally the Baltic), it will be necessary to analyse in more detail their monitoring mentioned in territorial waters and EEZs. Finally, as was done by France for its assessment in the 2nd cycle, the good management (and therefore anticipation) of this biological pressure requires a multi-scale analysis, and therefore also to take into account the assessments and censuses made in neighbouring countries and other regional seas (thus beyond the French EEZ).
- The national strategy on invasive alien species, published in 2017 (MEEM, 2017) and currently being implemented, already integrates the needs of several legal commitments. It will be important, for the many developments that remain to be carried out in the next MSFD cycles, to ensure that these new monitoring and indicators are consistent with these other commitments. For example, the challenges and priority of species listed for the Council Regulation 1143/2014 (invasive alien species) are not the same as those for the Ballast Water and Sediments Convention (specific pathway and vector) or those of species at risk of introduction or to be monitored as a priority under the MSFD (impacts on marine biodiversity and food webs) or WFD (water body quality) requirements.

Finally, all these analyses and developments reflect well the different stages of the implementation of the MSFD, both for the GES and monitoring and between the Member States and regional seas standards. Many ongoing works or future developments are mentioned or anticipated in these 2nd cycle reports, notably with risk-based approaches, new technologies, strengthening cooperation between coastal countries and increasing spatial and multi-scale coverage. The analysis and comparison of the reports of all these countries for the next MSFD cycles will make it possible to compare regularly (every 6 years) the progress made and the coherence, particularly in France, within the framework of European regulations and regional sea standards. Beyond the reporting cycles, and as a proven guarantor of coherence between the Member States, it will be even more important to maintain a constant and proactive watch within the working groups of the Regional Seas Conventions, to ensure the compatibility of the methodological developments in progress (GES and monitoring) by France, whose work and progress has already been numerous during these first two MSFD cycles, both at the national level and at the level of international cooperation.

8 List of tables

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Annex 1

Selection of additional information available on Member States' monitoring programmes for Descriptor 2 (2nd cycle):

MSFD reporting sheets in HTLM format, describing 20 NIS monitoring programmes and sub-programmes from 12 Member States (Belgium, Germany, Denmark, the Netherlands, Croatia, Italy, Estonia, Finland, Lithuania, Romania, Spain and Sweden) were available in the EU's central data repository (https://www.eionet.europa.eu/). Four of the monitoring programmes were reported as "continuation of those reported in the 1st cycle (2014)", fourteen programmes were reported as "modification of those reported in 2014", two were "new for this 2nd cycle" and one programme had no specific information of this type.

Reported monitoring had one (for 4 programmes), two (for 5) or three (for 11) objectives. The most common objectives were "pressures in the marine environment" (17), "state and impact of the environment" (14) and "effectiveness of measures" (13).

The type and frequency of monitoring differ from country to country and depend mainly on the element or pathway being monitored. This information is detailed in the table below, where available.

Information on monitoring strategies or sampling protocols is also provided in the HTML reporting sheets:

- In particular, Estonia, Germany, Lithuania, Spain and Sweden specify the use of the joint HELCOM / OSPAR or HELCOM protocols.
- Belgium states that it has based its monitoring of hard substrates on the NBN EN ISO standards (ISO 5667-1, ISO 16665: 2005 ISO 19493: 2007) and a scientific publication.
- Denmark specifies its environmental DNA monitoring based on the "Technical note for the collection of seawater samples and analysis of environmental DNA, ver. 1, 01-01-2020".
- The Netherlands links its monitoring programmes to OSPAR and the Ballast Water Management Convention.
- Croatia, Estonia and Romania cite several scientific publications as sources of information on the protocols used.
- Sweden provides internet links to the protocols used.
- Spain cites the UNEP-MAP (Barcelona Convention), WFD, OSPAR, joint HELCOM / OSPAR protocols and a scientific publication as references.

Finally, it is remarkable that countries with national waters in two regional sea conventions (Sweden, Germany, Denmark and Spain) report the same monitoring programmes for Descriptor 2 in their two respective regions. This reflects a harmonisation at both national and regional seas convention levels, as the programmes reported in the 1st cycle of MSFD were generally different depending on the marine region considered, for these same countries (Lizińska A. and Guérin L., 2020).

Table 1 chosen details of the Member State monitoring programs for Descriptor 2

		Monitoring type	monitoring frequency	Monitoring	Protocols
BE	ANSBE-P10-NIS	in-situ sampling coastal, land/beach, offshore	Continually	50 samples at artificial hard substrates windmill data: species lists occurrence, density, extensive list. other artificial hard substrates: species lists with the occurrence, ad hoc, info on substrates.	artificial hard substrates: scrape samples as described in NBN EN ISO 5667-1, ISO 16665:2005 ISO 19493:2007 and the Marine Monitoring procedures Davies et al, 2001
DE	ANSDE_MPr_031_MP_142	administrative data collection	As needed	The data to be evaluated are collected in national biological monitoring. Some of the information on neobiota is sent to the central neobiota platform North and Baltic Sea; mainly the databases must be specifically searched.	There is no specific method description for the compilation of available data.
DE	ANSDE_MPr_032_MP_050	in-situ sampling coastal	Yearly	Recording of introduced species by sampling natural and artificial substrates as well as vegetation plates placed in ports and marinas in the German North Sea.	eRAS description Hoppe, K., Buschbaum, C., D. Lackschewitz (2016) Extended rapid assessment survey of non-indigenous species - a tool for detecting trends in marine introductions. HELCOM document, 6 pages.
DE	ANSDE_MPr_032_MP_260	in-situ sampling coastal	One-off	The standardized collection according to HELCOM / OSPAR Port Survey Protocol (Regulation A-4) includes benthic samples from as many hard substrates as possible, grab samples from soft substrates, plankton samples (phyto- / zoo-), mobile macrobenthos including fish (if it is caught in certain fish traps with bait) and pathogenic germs	A detailed description can be found under: Joint HELCOM / OSPAR Guidelines on the granting of exemptions under the International Convention for the Control and Management of Ships 'Ballast Water and Sediments, Regulation A-4
DK	DK-D02-01	in-situ sampling coastal and sampling offshore, visual observation, other	6-monthly	marine sub-program in NOVANA eDNA for the detection of non-native species.33 stations, of which 16 stations are sampled twice a year (spring and autumn)	Technical instructions M30 - Non-native marine species, ver. 1, 13-06-2017. Technical note for the collection of marine water samples and analysis for 'environmental DNA' (eDNA), ver. 1, 01-01-2020.
DK	DK-D02-02	in-situ sampling coastal, visual observation, other		Monitoring of non-native species eDNA, in 6 ports every other year in both spring and autumn throughout the program period.	The activity has not yet started.
NL	ANSNL-D02-Sub1	in-situ sampling coastal and offshore	MWTL benthos every three years; phytoplankton,	The MWTL (benthos and phytoplankton), the Statutory Research Tasks (SRT) for shellfish and the monitoring of fisheries for the Common Fisheries Policy (CFP) Project-based monitoring (construction of wind farms, the impact of beach	The MSFD monitoring is linked to developments in OSPAR and any changes that ensue from the European Regulation on the prevention and management of the introduction and spread of

			SRT-Shellfish, CFP - annually	nourishment) and well-documented observations by the public (including divers.	invasive alien species (2014) and the Ballast Water Management Convention (2017).
HR	MADHR-D02-04	in-situ sampling coastal & offshore, visual observation, administrative data collection	As needed	Benthic species and areas are monitored by standard benthos research methods that include visual inspection, photo documentation, and sample collection. A sampling of benthopelagic fauna and mobile epifauna (fish, crustaceans) will be performed by the method of visual census with photo documentation. Commercial fishing monitoring programs already represent sampling with active and passive fishing gear. The introduction of planktonic alien species will be monitored as part of pelagic monitoring. Data collection is also done by involving the public in the observation network (citizen-science) through social media targeted investigations of NIS in hot-spot areas, but also through various monitoring programmes and scientific projects not necessarily primarily oriented toward NIS detection and assessment. Citizen Science campaigns as well as a survey of local ecological knowledge represent additional and important data sources.	Marasovic I., Krstulovic, N., Leder, N., Loncar, G., Precali, R., Šolic, M., Loncar,.G., Beg- Paklar, G., Bojanic, N., Cvitkovic, I., Dadic, V., Despalatovic, M., Dulcic, J., Grbec, B., Kušpilic, G., Nincevic-Gladan, Ž., P. Tutman, Ujevic, I., Vrgoc, N., Vukadin, P., Žuljevic, A. Coastal cities water pollution control project, Part C1: Monitoring and Observation System for Ongoing Assessment of the Adriatic sea under the Adriatic sea Monitoring Programme, Phase II. Interim report (IR), December 2013. https://jadran.izor.hr/jadranski_projekt_2/MJERNE-METODE-I-OPREMA.pdf R.Harris, P. Wiebe, J. Lenz, H. Rune Skjoldal and M. Huntley. 2000. ICES Zooplankton Methodology Manual; Utermöhl, von H. 1931. Neue Wege in der quantitativen Erfassung des Planktons. (Mit besondere Beriicksichtigung des Ultraplanktons). Verh. Int. Verein. Theor. Angew. Limnol., 5, 567–595.
IT	MWE-IT-D2-01, MIC-IT-D2-01	other	bimonthly - plankton, Six-monthly - benthic hard bottom scratching and movable bottom, biannual - benthic on panels	T, S, Secchi's disk. granulometry, phytoplankton using a Niskin net and bottle; mesozooplankton through vertical catches net200 µm, starting from one meter above the seabed up to the surface; macrozooplankton through visual census with observations from the edge or the quay. The macrobenthos of hard substrate through surface scratching and positioning of panels in some pilot areas; the macrobenthos of mobile substrate through the use of the bucket along each transept. Epimegabenthos vaguely using pots, subject to authorization by the harbour master.	
EE	BALEE-D02-19_NISDynImpact	in-situ sampling coastal	Yearly	Information on NIS occurrence is gathered from all biological monitoring stations.	biopollution is assessed on Olenin et al. 2007
EE	BALEE-D02-18_NISRiskAreas	in-situ sampling coastal	Yearly	The phytoplankton, mesozooplankton, zoobenthos, fouling, mobile epifauna and fish monitoring samples, HELCOM and HELCOM/OSPAR guidelines from two ports and three adjacent	Joint HELCOM/OSPAR Guidelines on the granting of exemptions under the International Convention for the Control and Management of Ships' Ballast Water and Sediments, Regulation A

				areas. Information on NIS occurrence is also gathered from all biological monitoring stations.	(https://www.helcom.fi/wp-content/uploads/2019/08/Joint-HELCOM_OSPAR-Guidelines.pdf)
FI	BALFI-D02-1	in-situ sampling coastal		harbour monitoring This program covers species, which are covered in the following monitoring programs: Zooplankton, phytoplankton, coastal hard bottom macroalgae and mussel communities, soft-bottom benthic animals and coastal fish monitoring programs. Alien species are also monitored in harbours with in-situ sampling. Accuracy of alien species extent is improved by individual sightings by experts and citizen.	HELCOM-OSPAR Joint Harmonized Procedure for BWMC A-4 exemptions https://portal.helcom.fi/meetings/MARITIME%2015-2015-245/MeetingDocuments/3-1%20HELCOMOSPAR%20Joint%20Harmonized%20Procedure%20for%20BWMC%20A-4%20exemptions.pdf
LT	BALLT-D02_NIS	in-situ sampling coastal and offshore	phytoplankton 1-7 times a year; zooplankton - 1-2 times a year; zoobenthos - once a year; fish - once a year		HELCOM Monitoring Manual: http://www.helcom.fi/action-areas/monitoring-and-assessment/monitoring-manual)
SE	SE-D2-NIS	in-situ sampling coastal, visual observation		HELCOM Guidelines for monitoring of non-indigenous species by eRAS, OSPAR CEMP Guideline: Common Indicator - Changes to non-indigenous species communities (NIS3) (Agreement 2018-04)	**Growth of biofouling on PVC-panels** and growth of organisms on different types of substrates such as wood, metal and plastic, mobile epifauna crustaceans - Upcoming method will soon be published **Phytoplankton** – https://www.havochvatten.se/vagledning-foreskrifter-och-lagar/vagledningar/ovriga-vagledningar/undersokningstyper-for-miljoovervakning/undersokningstyper/vaxtplankton.html **Zooplankton and gelatinous zooplankton** – https://www.havochvatten.se/vagledning-foreskrifter-och-lagar/vagledningar/ovriga-vagledningar/undersokningstyper-for-miljoovervakning/undersokningstyper/djurplankton-trend--och-omradesovervakning.html **and** https://www.havochvatten.se/vagledning-foreskrifter-och-lagar/vagledningar/ovriga-vagledningar/undersokningstyper-for-miljoovervakning/undersokningstyper/geleplankton.html **Macrofauna in sediments** – https://www.havochvatten.se/vagledning-foreskrifter-och-lagar/vagledningar/ovriga-vagledningar/undersokningstyper-for-miljoovervakning/undersokningstyper/mjukbottenlevande-makrofauna-trend--och-omradesovervakning.html **Mobile epifauna fish** – https://www.havochvatten.se/vagledning-foreskrifter-och-lagar/vagledningar/ovriga-vagledningar/undersokningstyper-for-miljoovervakning/undersokningstyper/provfiske-med-kustoversiktsnat-natlankar-och-ryssjor-pa-kustnara-grunt-vatten.html

RO	BLKRO-D2_PressureMarEnv_01	in-situ sampling coastal and offshore	6-monthly	Data collected from the existing national monitoring programme are useful in the MSFD monitoring to assess the NIS pressure in the marine environment	Todorova& Konsulova, 2005- www.blacksea-commission.org); Moncheva, 2010; Moncheva and Par. 2005 (updated-2010); Korshenko A. and Alexandrov B., 2006. Manual for zooplankton sampling and analysis in the Black Sea
ES	ES-EAI-1_AreasSensiblesInvasoras	in-situ sampling coastal and offshore	yearly	Bathymetric transects, characterizing the communities from the ground intertidal to infralittoral. The density of transects will be adapted to the heterogeneity of the habitats. In sedimentary bottoms or deeper bottoms beyond the infralittoral, the same methodologies will be applied.	UNEP/MAP Integrated Monitoring and Assessment Guidance (2016) (BC-001) WFD Guidance document n.° 32 - Biota Monitoring (WFD-032) OSPAR CEMP Guideline: Common Indicator - Changes to non-indigenous species communities (NIS3) (Agreement 2018-04) (OSP-007) Otero et al., 2013, Monitoring of invasive marine species in marine areas protected areas (MPAs) of the Mediterranean by MEDPAN ()
ES	ES-EAI-2_PuntosCalientesInvasoras	in-situ sampling coastal & offshore, administrative data collection	Every 6 years	It is a program focused on the detection of alien species, in areas with a high probability of introduction.	UNEP/MAP Integrated Monitoring and Assessment Guidance (2016) (BC-001) WFD Guidance document n.° 32 - Biota Monitoring) (WFD-032) OSPAR CEMP Guideline: Common Indicator - Changes to non-indigenous species communities (NIS3) (Agreement 2018-04) (OSP-007)" Joint HELCOM/OSPAR Guidelines for the Contracting Parties of OSPAR and HELCOM
ES	ES-EAI-3_EspecificoInvasoras	in-situ sampling coastal administrative data collection, Surveillance	Every two years	monitoring in each demarcation of the non-native species whose impact is potentially high. The methodologies used will be adapted to the target species type. For example, in the case of macroalgae, transects will be made bathymetric: on foot in the intertidal zone and by diving on the infralittoral floor. For other bathymetric levels deeper, the methodologies used in the monitoring programs of benthic habitats of the circumlittoral. The information collected in the framework of the rest of the monitoring programs will also be used. biodiversity, especially benthic habitat monitoring programs. The information collected through these various monitoring programs, will be integrated into a georeferenced database common to the whole of each demarcation.	UNEP/MAP Integrated Monitoring and Assessment Guidance (2016) (BC-001) WFD Guidance document n.° 32 - Biota Monitoring (WFD-032) OPAR CEMP Guideline: Common Indicator - Changes to non-indigenous species communities (NIS3) (Agreement 2018-04) (OSP-007)
ES	ES-EAI-4_Recopila	in-situ sampling coastal & offshore,	yearly	use of all sources of information on species non-native, derived from biodiversity study projects or programs already available, through the integration of all this information in a common	Martínez and Adarraga (2005 and 2006)

	DatosInvasoras	administrative data collection, surveillance		database in all Spanish marine demarcations. This base of data will be structured in such a way as to allow the application of the indicators associated with descriptor 2 at the demarcation, based on minimum criteria of standardization and coherence.	
ES	ES-EAI-5_DatosAdicionalesInvasoras	in-situ sampling coastal & offshore,	yearly	of two main components: - the compilation and integration in a common database of the relevant information contributed by all studies on marine alien species carried out within the framework of basic research projects and not included in other programs, - potential of citizen participation for the detection of certain easily recognizable invasive species.	

Annex 2

The survey form sends to all Member States NIS experts and persons responsible for reporting monitoring programmes in the MSFD 1st cycle.

1. Country (and marine reporting unit, if monitoring program differs from national)
   Country name

2. Your country D2 monitoring program is currently?

   - ☐ national works still in progress (please provide web link in "other", if possible)
   - ☐ under public consultations (please provide web link in "other", if possible)
   - ☐ ready to be reported to EU (please provide web link in "other", if possible)
   - ☐ reported to EU
   - ☐ other: click to fill

3. How many NIS (D2) monitoring programs will be reported by your country? (if possible please name them)
   Numer of NIS program and names

4. Elements included in NIS (D2) monitoring program

   - ☐ phytoplankton
   - ☐ zooplankton
   - ☐ macrobenthos
   - ☐ invertebrates
   - ☐ macroalgae
   - ☐ fish
   - ☐ mammals
   - ☐ reptiles
   - ☐ other: click to fill.

5. Parameters monitored in NIS monitoring program

   - ☐ presence of NIS
   - ☐ quantity and type of NIS
   - ☐ species composition of the group
   - ☐ species distributional range/ pattern
   - ☐ population size (abundance)
   - ☐ population size (biomass)
   - ☐ species abundance (numbers or cover)
   - ☐ spatial distribution/extent
   - ☐ temporal occurrence
   - ☐ trends
   - ☐ impact of NIS
   - ☐ other: Click to fill.

6. Pathways monitored in NIS monitoring program

- ☐ fishing
- ☐ ship-based transport
- ☐ harbour/ port/ marinas
- ☐ aquaculture or aquarium
- ☐ ballast water
- ☐ hull cleaning/biofuling
- ☐ live bait control
- ☐ waterways
- ☐ vulnerable areas
- ☐ other: Click to fill

7. Areas monitored in NIS monitoring program

- ☐ Terrestrial part of MS
- ☐ Transitional waters (WFD)
- ☐ Coastal waters (WFD)
- ☐ Territorial waters
- ☐ EEZ (or similar) (e.g. Contiguous Zone, Fishing Zone, Ecological Protection Zone)
- ☐ Continental shelf (beyond EEZ)
- ☐ Beyond MS Marine Waters
- ☐ other: Click to fill.

8. Are your MSFD monitoring standards shared with other conventions or regulations?

- ☐ WFD - Water Framework Directive
- ☐ CBD - Convention on Biological Diversity
- ☐ Habitats Directive
- ☐ Birds Directive
- ☐ Bathing Water Directive
- ☐ BWSC - International Convention on Ballast Water Management
- ☐ CFP - Common Fish Policy
- ☐ DCF - Data Collection Framework
- ☐ IAS Regulation - International Accounting Standards Regulation
- ☐ HELCOM -The Baltic Marine Environment Protection Commission
- ☐ OSPAR - The Convention for the Protection of the Marine Environment of the North-East Atlantic
- ☐ RSCs joint HELCOM / OSPAR Regional Seas Conventions
- ☐ UNEP/MAP - The Mediterranean Action Plan
- ☐ MedITS - An international bottom trawl survey in the Mediterranean
- ☐ Bucharest Convention
- ☐ Bern Convention
- ☐ Helsinki Convention
- ☐ BSIMAP - Convention for the Protection of the Black Sea Against Pollution
- ☐ BS-SAP - Black Sea Strategic Action Plan
- ☐ other: Click to fill.

Summary

The objective of this study is to compare the main elements reported by the European Member States for the Marine Strategy Framework Directive (MSFD, 2008/56/EC) of Article 11 (monitoring programmes) and Article 9 (definition of good environmental status), for Descriptor 2: " Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystems". This report is based on the elements communicated by the Member States for the 1st and 2nd MSFD cycles, as described in more than 50 available documents, supplemented by a survey specific to this study.

The evolutions observed between these elements compared between countries, regional seas, and at the scale of all the European Member States, have made it possible to characterise and interpret the trends, coherence and specificities at all these scales.

The analysis carried out on these multi-scale comparisons allowed us to conclude on the observed evolutions between many elements (GES, parameters, pathways and vectors, sectors, links between regulations, and trends between the two reporting cycles), both between countries and between regional seas. Important progress and many convergences are described and interpreted, notably and mainly through the observed general strengthening of the link with the Regional Seas Conventions. Recommendations are made for the French work following these conclusions.