

## JRC TECHNICAL REPORT

# Review of the Commission Decision 2010/477/EU concerning MSFD criteria for assessing Good Environmental Status

*Descriptor 8  
Concentrations of  
contaminants are at levels  
not giving rise to pollution  
effects*

MSFD Expert Network on Contaminants:  
V. Tornero, G. Hanke, A. Oros, A. Ramšak, A.  
Duffek, A.-S. Wernersson, A. Ausili, C. Maggi,  
C. Robinson, D. Tiganus, D. ten Hulscher, E.  
McGovern, G. Kušpilić, I. Ujević, J.  
Tronczynski, J.-C. Reninger, J. Mannio, J.  
Foden, K. Parmentier, L. Avellan, L. Viñas, N.  
Bihari, N. Green, O. Bajt, P. Whitehouse, P.  
Roose, P. Lepom, R. Law, S. Schmolke, V.  
Coatu, V. Milun, V. León, V. Besada.

2015

European Commission  
Joint Research Centre  
Institute for Environment and Sustainability

Contact information

Victoria Tornero  
Address: Joint Research Centre, Via Enrico Fermi 2749, I-21027 Ispra (VA), Italy  
E-mail: [victoria.tornero@jrc.ec.europa.eu](mailto:victoria.tornero@jrc.ec.europa.eu)  
Tel.: + 39 0332 78 9562

JRC Science Hub  
<https://ec.europa.eu/jrc>

Legal Notice

This publication is a Technical Report by the Joint Research Centre, the European Commission's in-house science service. It aims to provide evidence-based scientific support to the European policy-making process. The scientific output expressed does not imply a policy position of the European Commission. Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use which might be made of this publication.

All images © European Union 2015

JRC 96856

EUR 27464 EN

ISBN 978-92-79-51842-3 (PDF)

ISSN 1831-9424 (online)

doi:10.2788/015547

Luxembourg: Publications Office of the European Union, 2015

© European Union, 2015

Reproduction is authorised provided the source is acknowledged.

Abstract

This report represents the result of the scientific and technical review of Commission Decision 2010/477/EU in relation to Descriptor 8. The review has been carried out by the EC JRC together with experts nominated by EU Member States, and has considered contributions from the GES Working Group in accordance with the roadmap set out in the MSFD implementation strategy (agreed on at the 11th CIS MSCG meeting).

The report is one of a series of reports (review manuals) including Descriptor 1, 2, 5, 7, 8, 9, 10 that conclude phase 1 of the review process and, as agreed within the MSFD Common Implementation Strategy, are the basis for review phase 2, towards an eventual revision of the Commission Decision 2010/477/EU.

The report presents the state of the technical discussions as of 30 April 2015 (document version 8.0: ComDecRev\_D8\_V8), as some discussions are ongoing, it does not contain agreed conclusions on all issues.

The views expressed in the document do not necessarily represent the views of the European Commission.

## Foreword

The review of MSFD Descriptor 8 is being performed by the MSFD Expert Network on Contaminants, led by JRC. The review process was kicked-off during the working meeting of the MSFD Expert Network on Contaminants on 2-4.7.2014 in Ispra, Italy. Based on the exchanges there, a discussion document was prepared and circulated. The state of these discussions was reflected in the draft template document that was presented in October 2014 at the 12th WG GES meeting. These activities allowed the compilation and analysis of all necessary information for the identification of main issues and gaps and initial recommendations for the way forward, and with it the first part of the review process was completed.

The second part of the review process should then allow the finalization of conclusions and recommendations (which may include proposals for dedicated work items for better harmonization, need for additional guidance and eventually proposals for amendments to the Commission Decision). To this end, a questionnaire with specific questions on the main issues identified was circulated among experts and the outcome was analysed and discussed in the second working meeting of the MSFD Expert Network on Contaminants held on 23-24.2.2015 in Ispra. The current state of the discussions is reflected in the second part of the present template.

**MSFD Expert Network on Contaminants:** Andra Oros, Andreja Ramšak, Anja Duffek, Ann-Sofie Wernersson, Antonella Ausili, Chiara Maggi, Craig Robinson, Daniela Tiganus, Dorien ten Hulscher, Evin McGovern, Grozdan Kušpilić, Ivana Ujević, Jacek Tronczynski, Jean-Cedric Reninger, Jaakko Mannio, Jo Foden, Koen Parmentier, Lena Avellan, Lucía Viñas, Nevenka Bihari, Norman Green, Oliver Bajt, Paul Whitehouse, Patrick Roose, Peter Lepom, Robin Law, Stefan Schmolke, Valentina Coatu, Vesna Milun, Víctor León, Victoria Besada.

**EC JRC:** Victoria Tornero, Georg Hanke.

**Acknowledgments for contributions to:** Andrea Houben, Andrea Weiss, Christer Larsson, Concepción Martínez-Gómez, Daniel Gonzalez, Dick Vethaak, Dominique Boust, Hervé Thebault, Jean François Chiffolleau, Jessica Hjerpe, Juan A. Campillo, Juan Bellas, Karl Lilja, Maria Linderöth, Marie Aune, Michael Haarich, Thierry Burgeot, Thomas Lang, Tobias Porsbring, Tove Lundeborg, ICES MCWG.

**Descriptor 8: Concentrations of contaminants are at levels not giving rise to pollution effects**

<b>PART I: COMPILATION OF INFORMATION</b> .....	6
1. Approach .....	6
1.1 General guiding principles for the review.....	6
1.2 Definitions.....	6
1.3 Linkages with existing relevant EU legal requirements, standards and limit values .....	7
1.4 Linkages with international and Regional Sea Conventions (RSCs) assessment criteria and standards.....	8
1.5 Descriptor specificities should be highlighted and justified (e.g. if it is recommended to combine several descriptors together).....	10
1.6 Analysis of whether the criteria and/or indicators and/or methodological standards for the particular descriptor are likely to be common across the EU or need aspects to be specific at region or other scales .....	10
1.7 An indication of whether a quantitative GES definition for the descriptor will be possible or whether a qualitative/normative definition only should be used (on the basis of Article 3(5)).....	10
1.8 Climate sensitivity .....	10
2. Analysis of the implementation process.....	11
2.1 Summary of the findings relating to the determination of GES and specifically the use of the Decision criteria and indicators, based on the Commission/Milieu article 12 reports and the JRC in-depth assessment of the EU Member States’ Submissions for the Marine Strategy Framework Directive under articles 8, 9 and 10.....	11
2.2 Identification of any questions arising from the application of the current Decision, including those identified by the Commission/Milieu Article 12 reports.....	14
2.3 Good examples and approaches applied by MS, especially if used by multiple MS, and shortcomings should be listed systematically .....	14
3. Analysis of the current text of the Decision.....	15
4. Identification of issues .....	16
<b>PART II: CONCLUSIONS AND RECOMMENDATIONS</b> .....	31
5. GES criteria (in accordance with Art. 9.3).....	31
5.1 Conclusions on the use of the existing Decision criteria and indicators.....	31
6. GES methodological standards (in accordance with Art. 9.3) .....	33
6.1 Aggregation rules .....	33

7. Specifications and standardized methods for monitoring and assessment (in accordance with Art. 11(4)) .....	33
7.1 Specifications on methods for monitoring .....	33
7.1.1 Collection of data .....	33
7.1.2 Data quality requirements .....	33
7.2 Specification on methods for assessment .....	33
7.2.1 Scales.....	33
8. Rational and technical background for proposed revision.....	34
8.1 Justification and technical background justifying the above recommendations .....	34
9. Other related products .....	40
9.1 Proposed way forward for identified issues .....	40
10. Reference Documents.....	41

## PART I: COMPILATION OF INFORMATION

The first part of the review process has allowed the compilation of all necessary information to detect possible shortcomings, inconsistencies and gaps, and then to identify and discuss main issues and prepare initial recommendations. The information compiled here served as the basis for the discussions which were then held during the second part of the review process to shape the final conclusions and recommendations presented in the Part II of this template.

### 1. Approach

#### 1.1 General guiding principles for the review

The review of the Com Dec 2010/477/EU for D8 considers experiences made so far in the practical implementation, analyses the Commission Decision text in view of the current state of science and prepares recommendations for action in the MSFD Common Implementation Strategy (CIS) (Working Group on GES and Marine Strategy Coordination Group, MSCG), including the possible revision of the Commission Decision. The MSFD Competence Centre, in close collaboration with ICES and dedicated expert networks, will operate in partnership to deliver scientific and technical support for the MSFD implementation as identified in the CIS. EC JRC is responsible for coordinating the review process of Descriptor 8.

There are some keywords and concepts which should be considered when performing the review. The MSFD Commission Decision should be:

- Simpler
- Clearer
- Introducing minimum standards (to be enhanced by regions and MS, if necessary)
- Self-explanatory
- Coherent with other EU legislation
- Coherent with regional assessment methods (where EU methods do not exist)
- Include a clear and minimum list of elements and/or parameters per descriptor

Furthermore the development of additional common understanding within the MSFD Drafting Group GES during the review can lead to an adaptation of terms and concepts, aiming at an enhanced harmonization of the MSFD implementation. The focus of the Expert Network should be on technical scientific items and discussions. Ideally, the text of the Commission Decision should leave little space for individual interpretation by providing specific technical details on the parameters to be considered.

#### 1.2 Definitions

According to the WFD, **pollutants** mean ‘any substance liable to cause pollution’. The definition adds ‘in particular those listed in Annex VIII’. In addition, in the WFD, **hazardous substances** are defined as “substances (i.e. chemical elements and compounds) or groups of substances that are toxic, persistent and liable to bio-accumulate, and other substances or groups of substances which give

rise to an equivalent level of concern". This definition is in line with the definition of hazardous substances used in Regional Sea Conventions (RSCs), like OSPAR and HELCOM. Moreover, the WFD defines **priority substances** as "substances identified in accordance with Article 16(2) and listed in Annex X". Among these substances there are **priority hazardous substances**, which means substances identified in accordance with Article 16(3) and (6) for which measures have to be taken in accordance with Article 16(1) and (8).

As per Annex III of the MSFD, **contaminants** are synthetic compounds, non-synthetic substances and compounds, and radio-nuclides<sup>1</sup>. Therefore, the term "contaminant" relevant to the scope of Descriptor 8 of the MSFD encompasses hazardous substances, including priority substances and priority hazardous substances, but excludes three classes of pollutants from Annex VIII of the WFD, namely 'materials in suspension', 'substances which contribute to eutrophication (in particular, nitrates and phosphates)' and 'substances which have an unfavourable influence on the oxygen balance (and can be measured using parameters such as BOD, COD, etc.)'. These are covered under other Descriptors (namely 5).

**Pollution effects** are deleterious effects, such as harm to living resources and marine ecosystems, including loss of biodiversity, hazards to human health, the hindering of marine activities, including fishing, tourism and recreation and other legitimate uses of the sea, impairment of the quality for use of sea water and reduction of amenities or, in general, impairment of the sustainable use of marine goods and services, which result or are likely to result from the direct or indirect introduction into the marine environment, as a result of human activity, of substances or energy (MSFD Art 3.8).

**Acute pollution events** are events which can cause short time and severe pollution to the marine environment. They can be deliberate or accidental, e.g. illegal discharges and oil spills.

**Environmental quality standards (EQS)** are concentrations of pollutants which should not be exceeded in order to protect human health and the environment, as established in the context of the WFD, and thereby represent criteria for assessing whether Member States are in compliance (WFD Article 2, paragraph 24).

### 1.3 Linkages with existing relevant EU legal requirements, standards and limit values

Contaminants have a long history of being addressed through EU legislation and actions at the level of the Regional Sea Conventions. Directive 76/464/EEC on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community was one of the first water-related Directives to be adopted. The Directive covered discharges to inland surface waters, territorial waters, coastal waters and ground water. Directive 76/464/EEC has now been integrated into the Water Framework Directive.

The Water Framework Directive (WFD) (2000/60/EC) and its related Directives on Environmental Quality Standards (2008/105/EC as amended by 2013/39/EU) play an important role also for MSFD implementation and provide a reference point for the assessment of adequacy of implementation and facilitate coherence in MSFD implementation. The Directive on Environmental Quality Standards (2008/105/EC as amended by Directive 2013/39/EU) establishes Environmental Quality Standards

---

<sup>1</sup> JRC (2010), Task Group 8 Report, Contaminants and pollution effects

(EQSs) in the field of water policy, requirements for good surface water<sup>2</sup> chemical status. Chemical status is defined in terms of compliance with EQSs (measured in water or in biota), established for chemical substances at European level. The Directive also provides a mechanism for renewing these standards and establishing new ones by means of a prioritization mechanism for polluting substances. MS are required to take actions to meet those quality standards by 2015.

Directive 2013/39/EU introduced a number of revised and new EQS into Directive 2008/105/EC, in particular for concentrations in biota (e.g. for benzo[*a*]pyrene, dioxins, fluoranthene). The role of other standards in the context of the MSFD, such as OSPAR's Environmental Assessment Criteria (EAC – see next section), which have set threshold values for measurements in biota for the same substances, needs to be evaluated. This issue already arose with Directive 2008/105/EC for three substances (Hg, HCB and HCBd), for which a WFD EQS exists and an OSPAR EAC was set for biota.

The WFD is backed up by other EU legislation, such as the REACH regulation on chemicals, Urban Waste Water Treatment Directive (UWWTD), and the Industrial Emissions Directive (IED).

#### 1.4 Linkages with international and Regional Sea Conventions (RSCs) assessment criteria and standards

The integration of the results of chemical monitoring programmes, and combination of data from chemical and biological effects monitoring, is an active area of science within the Regional Conventions (i.e. OSPAR, HELCOM, Barcelona Convention and Bucharest Convention). Current experience indicates that integration is greatly facilitated by coherent and consistent sets of environmental quality levels (EQSs, EACs, etc). Further development work is necessary, through the EU, RSCs or MS, to expand the range of required quality levels to include a greater number of contaminants and biological effects, and to take account of mixture effects.

**OSPAR** has a framework with agreed monitoring programmes and associated assessment criteria to focus work on those chemicals which complement relevant activities under other frameworks (e.g. the Water Framework Directive, HELCOM). OSPAR has already made substantial progress in addressing those hazardous substances which pose a risk to Convention waters through implementing its Strategy on Hazardous Substances. A list of Chemicals for Priority Action has been agreed, and these chemicals have been evaluated to determine the risks they pose, what actions are needed to address those risks, and what monitoring strategies are required to evaluate the status of the North-East Atlantic with respect to those chemicals of key concern. In particular, in preparation of its Quality Status Report of 2010, OSPAR has established Environment Assessment Criteria (EAC) for the measurement of certain substances in sediment and biota. While these criteria do not represent legal standards under the OSPAR Convention, they can still guide Member States that wish to establish Good Environmental Status (GES) boundaries for contaminants in sediment and biota that are not covered by the EQS Directive. In addition, OSPAR has also been developing a number of Ecological Quality Objectives (EcoQOs), e.g. on oiled birds, which provide a set of clear environmental indicators defining a healthy North Sea as part of the ecosystem approach. As part of its role in coordinating MSFD monitoring, OSPAR has recently been developing Common Indicators to be used by Contracting Parties in their MSFD monitoring programmes. Several Common Indicators, or candidate Common Indicators, have been proposed for use under criteria 8.1 and 8.2.

---

<sup>2</sup> Surface waters with regard to chemical status are defined as inland waters, except groundwater; transitional, coastal and territorial waters.



In the **HELCOM** Baltic Sea Action Plan (BSAP), the objectives defined by HELCOM related to hazardous substances include:

- Concentrations of hazardous substances close to natural levels
- All fish are safe to eat
- Healthy wildlife
- Radioactivity at the pre-Chernobyl level

As part of the project HELCOM CORESET, a number of common indicators have been developed for the purpose of common monitoring and assessment in the Baltic. This set of core indicators includes indicators for hazardous substances and their biological effects, covering criteria 8.1 and 8.2 of the Commission Decision (apart from oil pollution). The substances in the HELCOM core indicators are mostly the same as in the OSPAR Quality Status Report. With regard to acute pollution events, HELCOM has been working for a long time on maritime activities within HELCOM MARITIME and has defined a number of objectives relevant to Descriptor 8, including the enforcement of international regulations (no illegal discharges), safe maritime traffic without accidental pollution and zero discharges from offshore platforms. An indicator for oiled water birds has also been developed within HELCOM.

The **Barcelona Convention** (UNEP/MAP) aims to prevent, abate, combat and to fullest possible extent eliminate pollution from the Mediterranean Sea. The Programme for the Assessment and Control of Marine Pollution in the Mediterranean region (MEDPOL) is the environmental assessment component of the Mediterranean Action Plan (MAP). The objectives of the monitoring activities implemented as part of MEDPOL Phase IV are to present periodic assessments of the state of the environment in hot spots and coastal areas, to determine temporal trends of some selected contaminants in order to assess the effectiveness of actions and policy measures, and to enhance the control of pollution by means of compliance with national/international regulatory limits.

The Barcelona Convention has given rise to seven Protocols addressing specific aspects of Mediterranean environmental conservation. Among those, the Dumping Protocol, the Protocol Concerning Cooperation in Preventing Pollution from Ships and, in Cases of Emergency, Combating Pollution of the Mediterranean Sea and the Protocol Concerning Specially Protected Areas, the Protocol on the Prevention of Pollution of the Mediterranean Sea by Transboundary Movements of Hazardous Wastes and their Disposal and Biological Diversity in the Mediterranean. Countries that are parties to the Convention report on the implementation of the protocols through their National Action Plans. The UNEP/MAPs EcAp (Ecological Approach) process has agreed on indicators to follow the MSFD Decision, with the aim to manage human activities, conserve natural marine heritage and protect vital ecosystem services. The objective related to pollution is described in the Ecological Objective number 9: "Contaminants cause no significant impact on coastal and marine ecosystems and human health."

The Black Sea is covered by the Convention on the Protection of the Black Sea against Pollution (the **Bucharest Convention**). In the Black Sea Integrated Monitoring and Assessment Programme (BSIMAP), each country is obliged to carry out ecological monitoring on marine stations, with particular emphasis given to eutrophication. BSIMAP include also contaminants (water/sediments/biota), with heavy metals, petroleum hydrocarbons as mandatory parameters, and others (OCPs, PAHs, etc.) as optional parameters.

### 1.5 Descriptor specificities should be highlighted and justified (e.g. if it is recommended to combine several descriptors together)

As with Descriptor 8, MSFD Descriptor 9 tackles the issue of marine chemical pollution but with the protection of human consumers as its goal. There have been discussions about the conceptual differences between the descriptors. Even a possible joining (though the MSFD is not up for revision) has been discussed but not been supported. Both descriptors are dealing with contaminants, they should therefore be discussed together, but have different objectives and characteristics. The conclusions about the differences and commonalities between the two descriptors are presented in the template for the review of Decision 2010/477/EU for Descriptor 9.

Moreover, the Descriptor 8 presents potential synergies with other MSFD descriptors:

Litter-associated contaminants: D8-D10; Biological Effects: D8-D1, D3, D4, D6; Biota sampling: D8-D3, D4, D6; Oiled seabirds: D8-D1, D4.

Coordination among the different descriptors and at an organisational level will be needed for efficient implementation. Discussion fora and responsibilities should be well defined.

### 1.6 Analysis of whether the criteria and/or indicators and/or methodological standards for the particular descriptor are likely to be common across the EU or need aspects to be specific at region or other scales

There are already analyses available which enable the identification of gaps and needs regarding the implementation of MSFD Descriptor 8. The MSFD GES workshop on Eutrophication and Contaminants held in October 2012 highlighted several technical issues that need to be jointly considered between MSFD and WFD for coherence of approaches, language and concepts and for effective information exchange. The issues that were discussed there included the identification and selection of the chemical pollutants and best matrices for monitoring and the quantitative criteria for GES determination/assessment. Moreover, the importance of designing monitoring programmes compatible and integrated with WFD and RSCs was also stressed, along with the need to cover open and deep sea areas in an appropriate, representative and efficient way.

Subsequently, the Commission's Article 12 assessment and the JRC in-depth assessment of the Member States (MS) reports for MSFD Articles 8, 9, and 10, published in February 2014, revealed a significant lack of coherence of approaches within and between Marine Regions. There were also great inconsistencies in the definitions of GES and environmental targets, both in their level of ambition and coverage and the ways (if provided) in which they are to be measured or achieved.

The results obtained in all these analyses can support the technical review of the Commission Decision on criteria and methodological standards as well as help to make suggestions for improvement in the next phase of MSFD implementation. This needs to be completed with experience available in the expert network on contaminants and is the scope of this work.

### 1.7 An indication of whether a quantitative GES definition for the descriptor will be possible or whether a qualitative/normative definition only should be used (on the basis of Article 3(5))

Considering the extensive and long-lasting EU legal framework on contaminants, particularly in water, it is expected that GES can be quantitatively defined in a coherent manner by all MS and across the regions, using similar criteria and methodological standards.

### 1.8 Climate sensitivity

Climate change might affect contaminant exposure and toxic effects. A changing climate may influence contaminant fate and transport, release contaminants currently stored in abiotic media,

such as snow and ice, affect the partitioning of contaminants between matrices and affect the transfer of pollutants through food chains to humans (Schiedek et al., 2007).

## 2. Analysis of the implementation process

2.1 Summary of the findings relating to the determination of GES and specifically the use of the Decision criteria and indicators, based on the Commission/Milieu article 12 reports and the JRC in-depth assessment of the EU Member States' Submissions for the Marine Strategy Framework Directive under articles 8, 9 and 10

### Descriptor 8

All but one of the assessed MS defined GES for Descriptor 8. There was however a considerable variation in the level of detail and the specific elements used. Most MS covered one or both criteria set out in the Commission Decision 2010/477/EU and only four gave a more generic descriptor text largely reproducing the definition provided in Annex I of the MSFD.

### Criterion 8.1 Concentration of contaminants

All MS that defined GES at Criterion level applied criterion 8.1. Many of them directly or indirectly mentioned the list of WFD priority substances (Directive 2008/105/EC), although they did not refer to all the listed priority substances. Moreover, a significant proportion of MS did not mention the substances to be evaluated when defining GES and environmental targets. It has been suggested that the level of coherence and comparability in the MSFD GES assessment in different regions of European seas might be improved by selecting an appropriate core set of contaminants of concern and ensuring they are well covered and monitored by countries. Even if every country has a different situation, this core group of contaminants should provide an adequate base for comparable approaches among MS, at least, at regional level.

For some parts of the marine environment there is an overlap in areas that are regulated under the WFD and the MSFD, and areas to which RSC apply. This is the case for coastal waters (1 nautical mile) for WFD priority substances and specific pollutants, and for WFD priority substances in territorial waters (usually 12 nautical miles). Most monitoring of hazardous substances, including that undertaken for RSCs, occurs in this coastal/inshore zone, reflecting the importance of land-based sources.

The selection of substances has to take into consideration the relevant provisions of the WFD for territorial and/or coastal waters as well as the special needs for the marine environment and prior knowledge of the degree of risk posed. We can assume that some WFD priority substances are also relevant in the marine environment, while others may not be (e.g. volatile solvents, some pesticides). The potential exclusion of WFD priority substances from the MSFD assessment should be justified. Within MSFD-WFD there should be no gaps regarding the consideration of relevant pollutants. At the same time, it must be ensured that only reasonable monitoring, and in the appropriate matrix, is done. This particularly concerns legacy and emerging pollutants, and the consideration of how monitoring should be linked also to the measures for pollution reduction.

The Commission/Milieu article 12 reports and the JRC in-depth assessment of the EU Member States' Submissions for the MSFD under articles 8, 9 and 10 have also shown a high variability in the matrices chosen to perform the assessments of contaminants. Most MS mentioned the three key matrices (sediments, water and biota) in their GES definitions, but some countries only referred to

one or two of them, in different combinations. Moreover, almost one third of MS did not specify the matrix in which measurements should be conducted.

Furthermore, the establishment of a common contaminant assessment approach is essential for the harmonious implementation of the MSFD Descriptor 8 within the EU. The WFD EQS should be used as a starting point, but, conversely, they were not included in the definitions of GES of a significant proportion of MS. Moreover, in many cases, MS did not specify their evaluation criteria and, if mentioned, it was not clear for which matrix and substance they were to be utilized. Despite potential differences in priorities and/or pressures, all MS should ensure they use coherent and comparable standards and harmonize their actions with neighbouring countries in order to facilitate the achievement of GES in their particular marine region. Moreover, WFD EQS are mainly defined only for water and GES should also consider adequate environmental criteria for sediments and biota as many MS have applied in their MSFD Initial Assessments reports. The application of OSPAR and HELCOM EAC has achieved a quite advanced level of harmonization in the North East Atlantic Ocean and the Baltic Sea, but harmonization is still lacking for the Mediterranean and the Black Seas.

It has also been questioned if freshwater species toxicological data and the biota-EQS derived from them can be applied for the protection of marine species. Marine species have different characteristics from freshwater species and might require a different level of protection. The water-EQS values take account of possible greater sensitivity of marine species by increasing of the assessment factor, e.g. ten-fold. For the biota-EQS, assessment factors have been applied where there was doubt, e.g. due to limited datasets. However, the biota-based EQSs themselves do not take the length of the food chain (longer in the marine environment) and the risks of biomagnification into account. Instead, the CIS Supplementary Guidance (No 32) on biota monitoring indicates how trophic level might be taken into account in applying the EQS, according to the species monitored.

The application of international standards still requires building up consensus on which standard the countries will use. However, so far there is no a single approach suitable for all key matrices/substances that allows comparability and an equal level of protection, so a number of questions still need to be addressed and agreed.

The Commission/Milieu article 12 reports have shown that a common feature across almost all MS is the lack of definition of aggregation rules. The temporal and spatial aggregation of data should be harmonised. Only two MS defined clear aggregation rules in their GES definition for D8 and one MS mentioned that they would be defined at a later stage.

### **Criterion 8.2 Effects of contaminants**

Most MS provided very limited information on the biological effects of contaminants and some MS did not report any data in this regard. These scarce available data showed a high variability in the biological effects methods reported (with the exception of the occurrence of imposex in gastropods, which was reported by many MS) and the specific substances determined.

The information with regard to the standards utilized to evaluate the effects of contaminants was also very limited and revealed little consistency. The OSPAR criteria, namely EcoQOs and EACs, were mainly used, even by countries outside the OSPAR Convention area. The reference levels developed in the Barcelona Convention and HELCOM were also considered by some MS and, in some cases, the

issue of biological effects was addressed only from the perspective of concentrations in biota. The inconsistencies and scarcity of information in the Initial Assessments can be related to the lack of common understanding on the issue of Biological Effects in relation to contaminant exposure. Indeed, a number of MS mentioned that the distinction between criterion 8.1 “Concentration of contaminants” and criterion 8.2 “Effects of contaminants” is confusing, considering that the standards used for criterion 8.1 (e.g. EQS or EAC) are defined taking into account the effects of pollutants on the marine environment.

There are still important gaps and needs that must be met to address the issue of biological effects and the lack of a legal framework in this regard may make it difficult to define GES boundaries. The aspects on which more research and scientific discussion are particularly needed seem to be the selection of proper and consistent biological effects methods and the criteria to assess them, and the coordination with programmes on biological effects monitoring conducted under RSCs.

The issue of acute pollution events (8.2.2) was almost totally neglected in the definitions of GES, since only four MS addressed it. The way to assess the potential impacts was practically reduced to the use of OSPAR EcoQO for oiled guillemots, which is targeted primarily at oil pollution from multiple sources, not a single incident.

While oil spills are a well-known and investigated threat in marine waters (IMO, Bonn agreement, EMSA, national emergency plans...), significant operational oil spills and discharges of other substances are an issue. There is a need to review relevant activities and gaps in spatial and temporal coverage. Moreover, the long-term impact of acute exposure from spills is also an important research topic.

Consideration under MSFD would be expected to be straightforward, as results from dedicated activities would only need to be reported as an aspect of GES.

### **Regional coherence for descriptor 8**

A very high variability was found among MS with regard to the contaminants and matrices for which information was provided. No one substance was assessed by all MS and even for some priority substances listed in the WFD and the WFD river basin specific pollutants, information was quite limited. There were also great inconsistencies in the definitions of GES and environmental targets, both in their level of ambition and coverage and the ways (if provided) in which they are to be measured or achieved.

Coherence in the North East Atlantic was found to be high, in the Baltic and Mediterranean to be moderate and in the Black Sea to be low. The level of coherence in the NEA marine region is higher in the North than in the South. In the Mediterranean Sea coherence is low for two out of four sub-regions.

The methodologies and data used by the MS sharing the North East Atlantic and Baltic regions were mostly based on the available assessments in OSPAR (Quality Status Report) and HELCOM (Holistic Assessment, HOLAS), respectively.

Another factor identified as a major source of uncertainty was the existence of different evaluation criteria for the same matrix and substance. None of the MS that are parties to the OSPAR

Convention and which used in their GES definition both the WFD EQS and the OSPAR's EAC, defined a priority order between these two standards.

## 2.2 Identification of any questions arising from the application of the current Decision, including those identified by the Commission/Milieu Article 12 reports

The inconsistencies encountered in the initial assessments could be explained taking into account that the EU MS "Submissions for the MSFD under articles 8, 9 and 10" used available information and data prior to MSFD implementation, thus it could be expected that inconsistencies will decrease in the next cycle. However, this cannot be taken for granted. In fact, inconsistencies have also been found at regional and subregional level, despite the longstanding experience in the RSCs. Consistency should, therefore, be searched as much as possible at European level, for example, by defining the minimum requirements (common set of indicators) as discussed later.

The lack, incompleteness or inadequacy of data found in some MS reports might partly be associated to the constraints of the provided reporting process.

In some cases, the inconsistencies and scarcity of information in the reports might be related to the lack of common understanding on some issues, for example, the issue of Biological Effects in relation to contaminant exposure.

Moreover, it is not easy to ascertain the lessons learnt from the WFD and identify what MSFD can do better according to WFD experience. It has been recognized that, while land-based issues should be tackled by the WFD, the marine environment needs, within the MSFD, provisions which go beyond the WFD.

## 2.3 Good examples and approaches applied by MS, especially if used by multiple MS, and shortcomings should be listed systematically

### Criterion 8.1:

One MS included radionuclides in the scope of their GES definitions. Four MS covered additional substances to the WFD priority substances, including substances relevant for HELCOM or OSPAR and some contaminants specifically for the purpose of the MSFD.

Three MS integrated aggregation rules directly in their GES definitions.

The question of hierarchy between the WFD EQS Directive and the EACs was not addressed by any MS, but one MS discussed the issue of complementarity between the two standards and mentioned the need to apply the precautionary principle.

Five MS mentioned that, in order to maintain GES, concentrations of contaminants should not increase, even if they remain below the threshold values.

### Criterion 8.2:

Two MS covered acute pollution events by looking at both the extent/frequency of events and the impact of oil on species.

Some MS directly mentioned the OSPAR EcoQOs in their GES definition (oiled guillemots, imposex).

### 3. Analysis of the current text of the Decision

The text of descriptor 8 has been analysed by highlighting the Com. Dec. text in order to check and identify where there may be terms or topics that need to be made more explicit, removed or incorporated.

- The following part of the Decision could be taken out and included in a guidance document, e.g. on how coordination between the MSFD and WFD could be achieved:

*The **concentration of contaminants** in the marine environment and their effects need to be assessed taking into account the **impacts and threats** to the ecosystem. Relevant provisions of Directive 2000/60/EC in **territorial and/or coastal waters** have to be taken into consideration to ensure proper coordination of the implementation of the two legal frameworks, having also regard to the information and knowledge gathered and approaches developed in **regional sea conventions**.*

- The following part of the Decision should be kept in the Decision as it defines the scope of Descriptor 8:

*The Member States have to consider the substances or groups of **substances**, where relevant for the marine environment, that:*

*(i) exceed the relevant Environmental Quality Standards set out pursuant to Article 2(35) and Annex V to **Directive 2000/60/EC** in coastal or territorial waters adjacent to the marine region or sub-region, be it in **water, sediment and biota**; and/or*

*(ii) are listed as **priority substances in Annex X** to **Directive 2000/60/EC** and further regulated in **Directive 2008/105/EC**, which are discharged into the concerned marine region, sub-region or subdivision; and/or*

*(iii) are **contaminants** and their total releases (including losses, discharges or emissions) may entail **significant risks** to the marine environment from **past and present** pollution in the marine region, sub-region or subdivision concerned, including as a consequence of acute pollution events following incidents involving for instance hazardous and noxious substances.*

#### 8.1. Concentration of contaminants

- **Concentration of the contaminants** mentioned above, measured in the **relevant matrix** (such as biota, sediment and water) in a way that ensures **comparability** with the assessments under **Directive 2000/60/EC** (8.1.1)

#### 8.2. Effects of contaminants

- **Levels of pollution effects** on the ecosystem components concerned, having regard to the selected biological processes and taxonomic groups where a **cause/effect relationship** has been established and needs to be monitored (8.2.1)

- Occurrence, origin (where possible), extent of **significant acute pollution events** (e.g. slicks from oil and oil products) and their **impact** on biota physically affected by this pollution (8.2.2).

However, the text should be revised in order to address the lack of accuracy and to clarify certain terms:

- The “substances” to be covered under D8 could potentially be integrated in the definition for criterion 8.1 rather than stand on its own as an introduction.

- Point (ii) refers to substances discharged and (iii) refers to total releases (including losses, discharges or emissions). These terms should be clarified and harmonized.
  - In Indicator 8.2.1, “Contaminant-related effects” might be more appropriate than “pollution effects”.
  - The term “contaminant-related effect” has a very broad meaning and should be clearly defined. *An example has been provided, although it stills requires agreement: “Contaminant-related effects on biological responses at or below individual level, to chemical or chemical mixtures that give a measure of exposure to certain class of contaminants and/or sublethal adverse effects in the target species”.*
  - The term “living ecosystem components (target species)” might be more appropriate than “ecosystem components concerned”.
  - Indicator 8.2.2 should say “source” instead of “origin”.
  - Indicator 8.2.2 should say “spatial/geographical extent” and not only “extent”.
  - The meaning of “significant” when referring to acute pollution events should be clarified.
  - Beside oil and oil products, other substances should also be mentioned.
- The following part of the Decision is a normative definition for Descriptor 8, and might affect the way EQSs are implemented:

*Progress towards good environmental status will depend on whether pollution is progressively being phased out, i.e. the presence of contaminants in the marine environment and their biological effects are kept within acceptable limits, so as to ensure that there are no significant impacts on or risk to the marine environment.*

Suggestions:

- This text appears complicated and unclear, and might profit from rewording.
- The meaning of “Acceptable limits” should be clarified.
- The term “trends” should be included in the text.
- Such a normative definition might not be needed if quantitative GES boundaries can be defined through the Commission Decision criteria and methodological standards. On the other hand, it might be useful because it can provide a steer to MS in defining or updating their environmental targets.

➤ Outdated

*(ii) are listed as priority substances in Annex X to Directive 2000/60/EC and further regulated in Directive 2008/105/EC...*

Directive 2008/105/EC has recently been amended by “Directive 2013/39/EU of the European Parliament and of the Council of 12 August 2013 amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy”.

#### 4. Identification of issues

This section presents the main issues and findings resulting from the previous assessments (the Commission/Milieu article 12 reports and the JRC in-depth assessment of the EU Member States’ Submissions for the MSFD under articles 8, 9 and 10), and from discussions held within the MSFD



Expert Network on Contaminants during the first phase of the review process for Descriptor 8. The identified issues are accompanied by initial recommendations for the way forward in addressing them and diverse comments, which could support further decisions and actions.

### **1. THE RELATIONSHIP BETWEEN THE WFD AND MSFD**

**Issue: The conceptual relationship between the WFD and MSFD.**

**Recommendation:** The MSFD programme should be built upon existing networks under other Directives, particularly the WFD. The relationships between WFD and MSFD should be described in order to understand what additional elements need to be considered in MSFD beyond WFD (e.g. areas outside WFD zone, other substances/matrices or the biological effects of contaminants).

**Comments:** Key marine-relevant issues include: the marine environment as a final receptor of contaminants, the marine environment to assess trans-(MS + EU) boundary contamination, specific ecotoxicology of marine species, contamination from sea-based sources (e.g. ship wrecks, ship lanes, dumped ammunition, offshore activities, etc.), the coverage of the open/deep sea and the marine bioaccumulation and biomagnification processes.

### **2. “CONTAMINANTS”, “POLLUTANTS”, AND “HAZARDOUS SUBSTANCES”**

**Issue: The clarification of these terms.**

**Recommendation:** Hazardous substances, priority substances and priority hazardous substances, as defined under WFD, are encompassed by the term contaminants.

**Comments:** The term “pollutant” could not be appropriate in the MSFD context, because it is defined under WFD as including substances other than the type of substances to be considered under MSFD Descriptor 8.

### **3. SUBSTANCES FOR WHICH GES CRITERIA SHOULD BE ESTABLISHED**

**Issue: The selection of a European core set of substances.**

**Recommendation:** A list of contaminants for GES assessment should be established based on:

- Minimum Requirements: core set of substances are the WFD Priority Substances (+ current and future amendments).
- A clear and justified mechanism for excluding WFD priority substances from the MSFD assessments if not relevant (see proposals below).
- Binding provisions for protection against other additional substances (marine region-specific substances, but also national/local) that might be relevant and would also need to be monitored.

**Comments:** The selection of a European core set of substances to be monitored by all MS would enhance harmonization, but the inclusion in the Commission Decision text of such list might also reduce the flexibility of future revisions.

The frequency of monitoring would be important in this context. For example, many substances which cause problems are legacy chemicals, and therefore their regular monitoring is appropriate and necessary, but the sampling frequency can be lower than for other compounds, particularly if measures are already in place to ban or restrict their usage.

It might be necessary to also select a core set of substances to be monitored in sediments and biota, taking especially into consideration the minimum requirements proposed by RSCs. The physicochemical properties of the contaminants, persistence and their interaction with sediments and biota should be considered.

**Issue: The criteria to include or exclude the substances to be monitored under Descriptor 8.**

Comments: According to the MSFD, it is for MS to define GES and harmonisation will therefore have to be at a high level. Instead of using an established list of substances, a risk-based approach may lead to a more flexible approach. Several conditions have been proposed to include/exclude the substances to be monitored and are summarized below:

- If the substance exceeds the PS EQS in riverine/estuarine inputs to coastal waters, it has to be monitored in coastal waters.
- If the substance exceeds the PS EQS in coastal/territorial waters, it has to be monitored beyond WFD waters.
- If the substance does not exceed the PS EQS in coastal/territorial waters but it is released into the region/subregion, or subdivision, it has to be monitored. However, there are probably numerous substances ending up in the sea in different ways and it would not be feasible to monitor all of them. Therefore, the term “released” has to be well clarified.
- If there are significant known sources beyond WFD waters, the substance should be monitored.
- Check if something affects the marine environment even if the theory says not. This point is controversial. Some experts propose, for example, implementing periodic screening of water or sediment samples using rapid, sensitive bioassays as early warning, as recommended by OSPAR. Other experts consider this bioassay example is not useful as a specific tool for MSFD monitoring.
- The legacy pollutants should be monitored and the appropriate frequency of monitoring established. There is a need to develop a remediation/protection concept as measures might not be possible for historical pollution or have already been taken.
- Aligning opting-out options with WFD: allow MS to exclude a substance.
- Contaminants with land-based inputs should be regulated by the WFD. This is effective for reducing input to the marine environment. MSFD needs to monitor/assess the elements not covered by the WFD. This point, however, is controversial. This suggestion might be valid, with the exception of the assessment of higher trophic levels for those substances whose biota EQS are based on human consumption of fish as the most critical route, so might not be sufficient to protect marine top predators.

**Issue: The role of radionuclides in the MSFD.**

Comments: There has been a lot of work in the radiological community to define thresholds for both human and wildlife protection. The thresholds are expressed as doses of ionising radiation so are not specific to a particular nuclide (or even the type of radiation). The EU ERICA and PROTECT programmes cover all this. OSPAR has considered knowledge available on the impact of environmental radioactivity on marine life and its application to the OSPAR area. According to the data available, calculated dose rates to marine biota are below the screening value at which effects

at the ecosystem level are likely to occur. The OSPAR Radioactive Substances Committee has also done work on the development of environmental quality criteria for the protection of the marine environment against adverse effects of radioactive substances. In HELCOM, and for Cs137, the target/GES is pre- Chernobyl level. The MSFD should follow the developments in these groups and use the criteria developed there.

#### **4. RELEVANT MATRIX IN WHICH MEASUREMENTS SHOULD BE CONDUCTED**

**Issue: The selection of the relevant matrix where a particular substance should be monitored.**

Recommendation: There is no reason to exclude a priori any applicable matrix to assess the concentration of contaminants: biota, water, sediment. Coherence with WFD is desirable.

Comments: Water presents large spatial and temporal variability (although this is not the case for certain large uniform water masses) and very low concentrations of many non-polar contaminants. Sediment or biota display often less temporal variability and seem to be more relevant, although they also present difficulties and some limitations. When adequate sampling and analysis techniques are present, water is a relevant matrix. For biota and sediment similar arguments are valid.

In the WFD, in addition to chemical and ecological status assessment, the prevention of further deterioration of the status of aquatic ecosystems is another important objective. Monitoring of contaminants in sediment and biota may be used to assess the long-term impacts of anthropogenic activity and thus, to assess the achievement of the above mentioned objective. To ensure coherence with WFD (as well as with OSPAR assessments), substances that tend to accumulate in sediment and biota may be monitored in these matrices for trend monitoring in the MSFD. Nevertheless, sediments and biota analysis give information about the spatial distribution of the contaminants, and can be also useful for the assessment of GES. Indeed, some MS have set standards for compliance assessment in sediments as equivalently protective for certain priority substances and applied them in the MSFD Initial Assessment.

The recent Priority Substances directive amendment places more emphasis on biota standards. The CIS Supplementary Guidance (No 32) on biota monitoring gives the possibility to choose relevant species and tissues for monitoring purposes, and means to recalculate the obtained values to a value that can be compared to the biota EQS of the new daughter directive.

**Issue: The uncertainties regarding the species that have to be considered under D8.**

Comments: In the WFD context, biota refers to fish or lower trophic levels, not to mammals or birds. Therefore, the EQSs in the amended priority substance directive might not be directly applicable to the latter, but might be after recalculation and adjustment of monitoring data to account for differences in trophic status and lipid content of the sampled species.

There are uncertainties in the consideration or not of migratory species under MSFD, for which interpretation of results requires the knowledge of seasonal migratory patterns, or the use of alternate biota matrices (e.g. mammals) as integrative matrices to provide a broader picture of the contaminant status in a region or seabird eggs for trend assessments.

*Recommendation:* The sampling strategy for biota must take into account not only the species but also the organ/tissue analysed and the frequency and seasonality of when biota should be sampled in order to minimize natural variability and to take account of the protection goal.

*Comments:* Guidelines for sampling biota (size, sex, maturation state, sampling period etc.) and sediments (fraction, etc.) are already available in RSCs, such as OSPAR, and there are also integrated guidelines (Davies and Vethaak, 2012, ICES advice, 2013, WFD Guidance document No. 25). Moreover, the CIS Supplementary Guidance (No 32) on biota monitoring covers sampling of biota for assessing compliance with new WFD biota EQSs. It does not specify species/age etc., but gives guidance on how to allow for differences. The guidance is supposed to cover both freshwater and marine biota.

## 5. METHODOLOGICAL STANDARDS

### ***Issue: The appropriate thresholds for the assessment of GES.***

*Comments:* It is not clear whether to introduce WFD EQS in the text, and recommend the use of other standards (e.g. OSPAR EAC, national standards) when no EQS are available or when EQS were not derived from environmental toxicity data, or whether to define a coherent, ideally single, chemical assessment regime across waters under RSC, WFD and MSFD.

The establishment of EQS has been limited for the majority of priority substances to water only, so the principle matrix for assessing compliance with respect to EQS is whole water, or for metals, the liquid fraction obtained by filtration of the whole water sample. However, many pollutants are present in water at very low concentrations, often below the limit of detection and hydrophobic contaminants tend to accumulate in biota and sediments. Therefore, the development of specific EQS for these latter matrices is recommended.

Furthermore, specific attention has been focused on why EQSs are sometimes lower than calculated Background Concentrations (BCs), which is an ongoing discussion under WFD. The reasons for this need to be better understood (e.g. because no environmental toxicology criteria were used for the EQS establishment and/or because of the assessment factors applied when few data are available?).

Sediments are the last recipient of many pollutants but there are no EQS for sediments set at EU level. OSPAR EACs are assessment tools intended to represent the contaminant concentration in sediment and biota below which no chronic effects are expected to occur in marine species, including the most sensitive species. EAC can be environmentally representative reference data, and consequently they might fill the current gaps, i.e., when WFD EQS are not available.

There are close similarities between OSPAR EACs and the EQSs developed under the WFD, though they are not interchangeable. The OSPAR 2004 EAC methodology defined EACs to relate to EQSs under the WFD, so that they were based on the EC Technical Guidance Document (TGD) on risk assessment and WFD frameworks for deriving PNECs or QS values. The EAC methodology, however, focused on ecological risks and had less emphasis than EQSs on human health considerations (e.g. through food consumption or drinking water abstraction). As for EQSs, the OSPAR EAC methodology does not take into account specific long-term biological effects such as carcinogenicity, genotoxicity and reproductive disruption due to hormone imbalances, and does not include combination toxicology. For organic contaminants (PCBs, PAHs), OSPAR initially determined EACs for water,

following the EQS TGD procedure, and then converted the water EACs to lipid or organic carbon concentrations based upon partitioning theory. EACs for organics in mussels/oysters were further converted from being expressed on a lipid-weight basis to being expressed on a dry weight basis, assuming 1% lipid and 20% dry matter content. It should be noted that EACs have not been agreed for all substance/matrix combinations that OSPAR assessed in the 2010 Quality Status Report (OSPAR QSR2010). For metals in fish, fish liver and mussels/oysters, OSPAR EACs were not agreed and the EU Food Health Regulations (1881/2006) were used for assessing Cd, Hg and Pb in biota for the QSR2010; the food limits for bivalves were applied to data on Cd and Pb in fish liver.

There are other environmental criteria, such as the US Effects Range Low values (ERL) (Long et al. 1995), which are applied in other countries (USA, Canada, etc.). These criteria were used for assessing metals in sediments for the OSPAR QSR2010 since OSPAR EACs were not agreed. However, the procedure by which ERL criteria are derived is very different from the methods of derivation of EACs and EQSs, and a precise equivalence between the two sets of criteria should not be expected. Moreover, in practice, the use of these environmental criteria is not common in Europe.

**Issue: The relevance of the WFD EQSs for the MSFD.**

**Comments:** The most relevant addition would be to include more marine taxa, but only for those EQSs which are now derived with an additional assessment factor because of a lack of data for marine species. It should be noted that for taxa that include marine and freshwater species, there is no clear evidence that marine representatives are more sensitive than their freshwater relatives. The taxonomic position rather than the habitat seems to be important. For the marine environment, testing species from exclusively marine taxa such as sea urchins may have added value.

The generation of new toxicological data from marine species should be a priority as a way to get useful criteria for the assessment of marine environment. Marine toxicity data should become a requirement under REACH for new and current-use substances, but will not cover all relevant substance categories.

**Issue: "Comparability with WFD".**

**Recommendation:** To define what needs to be comparable (matrix, substances, analytical methods, quality control...) and where (territorial waters, open sea...). This "comparability" is incongruent for sediments and/or biota when there is no available EQS.

**Comments:** For sediment, no EQS are set at EU level, but there might be  $QS_{sed}$  (some are more preliminary than others though).  $QS_{sed}$  should be based only on predicting risks to benthic organisms, although if based on equilibrium partitioning, they might be based on risk to human health or other organisms.  $EQS_{biota}$  were developed when the highest risk has been considered to be related to secondary poisoning or human risk from consumption. If sediment (or biota) matrix is used for assessing risk to whole marine environment, then the standard should be protective of the most vulnerable species in that environment, and could (should?) be derived by calculation from the EQS for water.

Seven out of eleven  $EQS_{biota}$  laid down in Directive 2013/39/EU have been set to protect humans from adverse health effects via consumption of fish products. Moreover, the monitoring in the CIS

Supplementary Guidance (No 32) on biota monitoring is designed according to how these EQS biota values have been derived, i.e. to protect the top predator and/or human health, focusing on a high trophic level, and so analysing the whole fish (as eaten by a top predator) or the fillet (as predominantly eaten by humans). Therefore, these EQS might be not relevant for contaminant monitoring under D8. Furthermore, EC Food Regulation limits for protecting humans are derived using an assessment of the risk based upon dietary intakes – it is not clear that this is the case for EQSs intended to protect human health (e.g. for PBDEs). There are some recommendations in the CIS Supplementary Guidance (No 32) on biota monitoring about converting between fillet and whole body concentrations, but these cannot currently be used to perform a valid assessment due to the lack of the required species-specific conversion factors.

As some of these substances (such as PBDEs and PFOS) are indicators in OSPAR and HELCOM, and don't have EAC or BAC in fish defined, the  $QS_{\text{biota secondary poisoning}}$  derived under the WFD could be useful for compliance checking under MSFD D8 as well.

## 6. BIOLOGICAL EFFECTS

**Issue: The distinction between criterion 8.1 “Concentration of contaminants” and criterion 8.2 “Effects of contaminants”.**

**Recommendation:** There is a clear difference between criterion 8.1 “Concentration of contaminants” and criterion 8.2 “Effect of contaminants”, i.e., pressure and impact. The concentration of contaminants provides the information about the presence of a certain contaminant in the marine environment that might cause effects on marine organisms or human health. The effect of contaminants provides information on the exposure and impact of contaminants (including mixtures) on marine organisms and can respond to contaminants which are not being monitored individually by chemical means.

**Issue: The assessment of the effects of contaminants for the MSFD.**

**Recommendation:** Contaminant-related effects have to be clearly defined.

**Comments:** Contaminant related effects has a very broad meaning. It can refer to one particular chemical or chemical mixtures as well as contaminant-specific (e.g. imposex and TBT) and general stress responses including contaminants (e.g. fish diseases, lysosomal membrane stability in mussel, etc.). Moreover, clarification is also need regarding the lowest biological organisational level that should be assessed: sub/cellular, tissue or individual..

Contaminant effect monitoring in the WFD is an investigative tool, and not to check compliance of levels of contaminant-related effects. EQS values can be derived from laboratory toxicity studies with water organisms, but can also be derived from observed effects in fish eating birds or mammals. In both cases, the observed effect concentrations are translated to the proper trophic level and safety factors are applied. These values do not protect individual fish, but do protect a population. EQS values are derived for single contaminants and do not take into account the effect of other stressors. So looking at bioeffects may provide additional and relevant information.

Contaminant-related effects in the MSFD could be defined in line with the biomonitoring programmes developed in RSCs, which are based on the integrated use of chemical and biological measurements (biomarkers and bioassays). A key issue here is whether the specific biomonitoring

technique is being used as a diagnostic tool (to identify the likely cause of an impact) or a broad spectrum screen (to determine whether or not there is an impact, but whose cause may be unknown).

*Recommendation:* A range of effects methods is needed in order to investigate the range of organism responses, however a core set of biological effects to be monitored at European level (and also their methodologies, thresholds, and the level of QA/QC needed) should be yet further discussed and eventually selected.

*Comments:* “Substance specific” tools are valuable to confirm assessments based on chemical data, whereas tools that respond to larger groups of substances (such as “oestrogenic substances”, “PAHs”, “metals”), but still primarily contaminants, are valuable to cover also substances not being monitored individually by chemical means (for economic or technical reasons), and can also take the combined effects into account. The fact that some of these “general” tools might also respond to other types of pressures and other factors, should not be sufficient reason for “disqualification”. However, some types of effects are perhaps too general and could really respond equally well to other stressors than contaminants, and such types of analyses could also be considered under other descriptors (probably Descriptor 1). As said before, a key issue is to choose between diagnostic or broad spectrum tools.

It has been also suggested that all types of effects monitored and observed are of value. But in the assessment of status, focus should be on risks to higher levels (individual, population, community). Therefore, instead of assessing GES based on certain types of individual endpoints, it might be appropriate to adopt integrated assessment schemes, to assess/predict effects/risks on individual and population/community levels when the actual data stem from lower level monitoring data (such as cellular/enzymatic responses). Individual threshold levels might be suitable for imposex and eelpout malformations, which could probably be assessed in a “stand alone” manner, but not for EROD, vitellogenin (VTG) induction etc., which should be assessed together with other lines of evidence. In the first case, the risks to populations are clear. But EROD and VTG are rather considered “early warning” signals, so deviations should trigger further investigations. Together with other data, sufficient background would be available to assess not only status but frequently also give an idea about what type of compounds are involved.

External fish diseases, certainly not substance specific, have been mentioned as indicators of biological effects that could/should be considered for incorporation in monitoring under D8, although it has been also said that this issue could be tackled under D3 and D1 (species condition).

The choice of a limited number of biological effect-based indicators to investigate the range of organism responses was proposed by Davies and Vethaak (2012) with the following criteria: i) validated methods; ii) integrated QA/QC scheme (e.g. Bequalm project); iii) EAC/BAC determined for each indicator. A list of core biomarkers indicators exists and is the result of the work done within ICES (Davies and Vethaak, 2012). The Barcelona Convention also relies on the limited number of these biomarker indicators.

***Issue: The establishment of cause/effect relationships in the marine environment.***

Comments: The establishment of unequivocal cause/effect relationships in the marine environment is unfeasible since effects include consequences of exposure to multiple contaminants and indeed combined with multiple stressors. However, unequivocal cause/effect relationships have been demonstrated in laboratory exposures for the biological effects recommended by ICES (except, possibly, external fish disease). Certainly, some biological effects reflect the presence of certain contaminants or group of contaminants (e.g. imposex /TBT, PAH metabolites and DNA adducts...), but it is still difficult to ascribe a specific effect to a given chemical. As most biological effects can be caused by several substances (as well as by other stressors not related to chemicals), the main utility of effects measurement is often to provide assurance against cumulative effects due to contaminant mixtures and give an integrated picture of health status.

It should be underlined that the biomarkers responses established as mandatory or recommended by RSC like OSPAR have a cause/effect established after validation in laboratory and field studies, although many of them are not specific to a given chemical but to group of contaminants.

**Issue: The available guidance on effect-based monitoring.**

Comments: The available guidance on effect-based monitoring tools seems to be insufficient to meet the MSFD requirements. The technical report on aquatic effect-based monitoring tools elaborated by the subgroup Chemical Monitoring and Emerging Pollutants (CMEP) under the CIS WFD (Wernersson et al., 2014) is very generic and presents many effect methods since its main aim is to present the state of the art of aquatic effect-based monitoring tools for toxic substances from a broader WFD perspective. The list of biological effects recommended by ICES (Davies and Vethaak, 2012) is shorter and presents detailed guidance on techniques, assessment thresholds and integration / aggregation. Moreover, the Joint Assessment and Monitoring Programme (JAMP) of the OSPAR Commission also includes a substantial biological effects monitoring component (JAMP 1998a, 1998b, 2007).

**Issue: The ways to address biological effects coherently between MSFD and WFD.**

Comments: So far, there are no or few tools implemented at national levels to assess effects from contaminants by biological means in the WFD context (Wernersson et al., 2014). However, by performing the MSFD assessment of contaminant effects on risks to higher organisational levels, such as populations and communities, the protection goals should be the same.

The use of fast and cheap bioassays in water or passive sampling extracts or biomarkers recommended by RSCs in target species from coastal and open sea waters should be applied to link WFD with MSFD.

**Issue: The implications for MSFD in cases where the relation between effects with potential measures should be clarified.**

Comments: It is not always necessary to know the exact identities of the individual compound/s behind an effect to adopt suitable measures, as long as there is an idea about most likely sources. By monitoring effects before and after such measures, it is still possible to assess whether the measures were effective. If an effect is observed, the next step would be to trigger MSFD investigative monitoring to identify the chemical substance causing the effect and, if the substance is identified and land-based sources are suspected, to trigger WFD investigative monitoring.



**Issue: The appropriateness of obligatory monitoring without necessarily checking compliance, i.e., separating compliance from risk assessment.**

Comments: In that case, the appropriate quality elements must be defined. Perhaps by identifying two different criteria, those used for status assessments, and those used to trigger investigations (e.g. fish tumours). There is a key difference between compliance and a status assessment. Status assessment is whether environmental health is acceptable, whereas compliance is comparison with a legal standard (EQS).

## **7. ACUTE POLLUTION EVENTS**

**Issue: The minimum requirements for indicator 8.2.2.**

Recommendation: Apart from petroleum spills, vegetable oil spills are quite frequent, usually due to washing out of tanks in product tankers, and other chemicals can be spilled as well and damage the environment, so they would also need to be considered.

Comments: Reporting on acute pollution events is practically based only on what has been done under the Bonn Agreement / HELCOM. Reporting accidents, including frequency of occurrence and spatial coverage in order to determine the magnitude of the spills, and OSPAR EcoQO on oiled birds to assess impacts on biota could be considered as the minimum requirements for indicator 8.2.2. However, this would need further clarifications, e.g. whether the magnitude of the spill refers to HELCOM statistics or whether EcoQO on oiled birds would be applied by all MS taking into account that it is a North Sea EcoQO and it is not even applied throughout OSPAR and it is not specific for acute pollution events.

It has been also suggested that the assessment of dangers of oil spills is described under the Bonn Agreement and, therefore, no new criteria or assessments should be introduced. However, the Bonn agreement does not apply to much of the North Atlantic Sea (including Bay of Biscay), nor to the Mediterranean or Black Sea.

**Issue: The selection of appropriate reporting units to make this indicator quantitative.**

Comments: Apart from the International Convention for the Prevention of Pollution from Ships (MARPOL) obligations, there is no other EU framework for occurrence, origin and extent of acute pollution events, so quantitative GES boundaries would be based on the obligations for reporting under national registers or related to the target impact group, e.g. seabirds.

**Issue: The selection of sampling sites for monitoring, i.e. whether monitoring should be associated to already known spills or whether modelling should be used to identify prospective monitoring areas.**

Comments: Sampling for acute pollution events should be directed by occurring incidents, and should not be put into a standard monitoring network. Sampling sites should not be selected in advance.

There are guidelines for this issue developed by ICES and OSPAR and published in Martínez-Gómez et al. (2010).

**Issue: The meaning of “impact on biota physically affected” in indicator 8.2.2.**

Comments: The fact that the indicator 8.2.2 says “impact on biota physically affected” implicitly limits the assessment to oil and chemicals which exert smothering effects and excludes the direct toxicity of chemicals. It is important to know whether this means that an accident at sea with chemical spill wouldn’t have to be considered under 8.2.2 and would be already covered under 8.1. Acute toxicity should be considered under 8.2.2, whilst chronic toxicity (including repeated minor spills) should be considered under 8.2.1.

**Issue: The consideration or not of “minor spills” under Indicator 8.2.2.**

Comments: Oil spill events which are too small or less acute to be considered under multinational frameworks, can be frequent and, taken together, be quite significant, (on national scale, volume has been estimated to correspond to at least one large oil tanker each year). However, there are not established guidelines on what has to be reported (e.g. minimum size) and perhaps they are covered through e.g. PAH or sea bird monitoring and then assessed through Indicators 8.1 and 8.2.1.

## **8. MONITORING**

### **8.1. TRENDS**

**Issue: The consideration of trends.**

Recommendation: Trends must be considered. They could be considered for the assessment of GES and effectiveness of measures, in line with WFD provisions. Trend monitoring is necessary:

- For substances of category iii (with no EQS) in order to obtain indications about risks for these type of substances (when not (yet) possible to evaluate concentrations in “absolute terms”).
- When the concentration of a substance is above EQS in order to ensure the trend in concentrations is decreasing.
- For some PS even if they are below EQS but when their concentrations/inputs are expected to increase (align with WFD non-deterioration principle, and perhaps even more clearly related to Art. 3 in 2008/105/EC, by which trend monitoring of accumulating substances is required and measures undertaken if increasing significantly). However, what is meant by “significant increase” and with which statistical power need to be clarified.
- Sediment trends monitoring.

**Issue: The monitoring frequency to assess reliable trends.**

Comments: The monitoring frequencies (including retrospective analysis of archives samples, if available) should be established attending to pollution sources, physicochemical properties of pollutant groups and the hydrodynamic conditions (sedimentation rate in the case of sediments, etc.). Trend analysis could be done on a very few sites representative of the wider (sub-)region, but would need to be done regularly (annually, biannually or every X years) to have any statistical meaning; or done very infrequently using dated sediment cores. If performing the trend analysis according to the priority substance directive (analysing once every third year as a minimum), the “trend” needs to be very steep in order to detect a significant change compared to the previous water management cycle (within 6 years).

**Issue: The acceptable limits to control that concentrations do not reach EQS.**

Comments: This could refer to identify concentrations (for example, 75% of the EQS) at which any significant increasing trend needs to be turned. However, it has been also said that the trend assessment just represents a safeguard mechanism and this approach might seem more a speculative research than a useful tool for the correct implementation of the MSFD.

## **8.2. SAMPLING STRATEGY**

### **Issue: The role of passive sampling.**

Comments: Passive sampling is a methodology to assess dissolved concentrations in water and in sediment porewater and so the bioavailability and exposure by that route. Passive sampling of hydrophobic contaminants (e.g. PAHs, dioxins, etc.) can provide information on lipid concentrations that would be found in biota, if they were at equilibrium. By acting as an abiotic reference phase, passive sampling provides a measure of pollutant pressure in the environment, in the way that a thermometer measures heat; furthermore, passive sampling is able to provide information on what the level of exposure to (e.g.) PAHs is, even though they cannot be measured meaningfully in whole fish/ fish fillet due to metabolism.

Passive sampling derived concentrations can be representative in low concentration of suspended solids waters. Passive sampling of porewaters / sediments can inform on the bioavailability of substances in sediments, and (by being equilibrium sampling), it integrates over the same time period as the sediment itself.

Passive sampling should not be regarded as an additional matrix or as mimicking biota, at least not when the protection goal is related to secondary poisoning. The “food pathway” is not present in a passive sampler. For substances that are rather of concern because of accumulation in invertebrates (lower trophic level biota to be monitored), this could be an alternative, but taking into account that passive sampling actually measures chemical activity, that is the “pressure” for pollutants to move from one phase (e.g. particulate matter or water) into another (e.g. organism lipids or passive sampler). It is this measurement (chemical activity) that is relevant in determining potential exposure, particularly for lower trophic level organisms, including most fish spp.

## **8.3. SCALES AND AGGREGATION**

### **Issue: The scale for selecting the substances that are relevant for the marine environment (national, regional, European).**

Recommendation: Typically, marine pollution is expected to represent a transboundary problem, as ocean hydrodynamics can carry the contaminants far from their source and, therefore, regional coherence is essential. Minimum set of substances should be agreed among EU MS in the region/subregion and neighbouring countries, preferably through RSC.

Comments: Harmonization in the Mediterranean and Black Sea is still an issue. In these regional areas, assessment of D8 data could be done by using assessment criteria developed in other RSCs or those developed at national level as it has been performed by several countries in their Initial Assessments. Moreover, due to the transboundary nature of marine pollution, the best possible identification of pollution sources and pathways should be looked for.

**Issue: The eventual use of combined weight of evidence approaches to provide integrated assessments of GES.**

Comments: If there are separate indicators and targets for concentrations and effects, the eventual use of combined weight of evidence approaches to provide integrated assessments of GES should be discussed. There are examples in Davies and Vethaak (2012), although maybe they are resource intensive. Other suggestions include the use of Weight of Evidence (WOE) approach.

It has been also mentioned that the integration in WFD is performed at water body level, which is coherent and possible, but in MSFD Initial Assessments, integration has been performed at demarcation levels, which are higher and more complex. Consequently, it is not recommended to integrate at this level and the criteria of maximum protection should be applied. Within OSPAR and HELCOM the integration / aggregation is proposed to be nested at appropriate scales, e.g. water body, coastal waters, national waters, sub-regional. A basic and common procedure to integrate contaminant or pollution indicators should be proposed (e.g. Davies and Vethaak, 2012).

**Issue: The appropriate aggregation rules.**

Comments: There are some guidance documents for data aggregation methodologies: Deltares report (2014), Davies, and Vethaak (2012), ICES advice (2013).

The approach of establishment of a % as a threshold level for the total GES of the interested area, can follow as starting point the integrated assessment methodology proposed by ICES/OSPAR (Davies and Vethaak, 2012). There are, however, serious and complex issues with this approach. The level of the GES threshold must depend on the design of the sampling programme – if sampling is risk-based and targeted at coastal hotspots (i.e. ignoring most of the sub-region), then the GES threshold should be lower (or a weighting factor needs applying) compared to if sampling is randomised across the whole of the sub-region.

#### **8.4. MONITORING PROGRAMMES**

**Issue: The harmonization of the monitoring programmes.**

Comments: Monitoring programmes have been already designed by MS with a differing degree of consultations at regional and EU level, so there could still be a lack of consideration of the lessons learnt (in-depth assessment, article 12 report). An insufficiency in harmonization among MS at regional or EU level might lead to new inconsistencies in the second MSFD reporting cycle, if not addressed before the establishment of the monitoring programme for that cycle.

There is not much specification on the sampling grids used and, in fact, sampling grids might not be necessarily the best approach.

**Issue: The appropriate coverage of deep/open sea areas.**

Recommendation: Deep/Open Sea areas have been found to be scarcely considered. There is a need to cover also these areas in a representative and efficient way, where risk warrants coverage.

Comments: Clear definitions of Open/Deep Sea are needed, as well as of “where risks warrant coverage”.

**Issue: Quality assurance/Quality control.**

**Recommendation:** The WFD provides data quality requirements for chemical analysis (Commission Directive 2009/90/EC), and could be taken into account for marine monitoring. Proficiency testing schemes must consider the properties of marine matrices.

While MS have mostly submitted their monitoring programmes under MSFD Art. 11, the MSFD Expert Network on Contaminants was consulted during the first meeting held in Ispra on the state and content of the MSFD monitoring programmes of Descriptor 8 in their respective countries:

**Belgium:** Monitoring programmes under public consultation: Coordination with institutions for D8 and with Food safety legislation for D9. No deep sea to be considered.

**Croatia:** Public consultation of monitoring programmes is finished. For D8 concentrations of contaminants will be measured in sediment and biota (mussels and fish). Information for concentrations in water will be obtained from national, WFD-harmonized, monitoring programme. Contaminant effects in seawater, sediment and biota (mussels and fish) will be investigated. How to assess acute pollution effects is still open. Monitoring will be performed from coastal to open sea areas. Deep sea areas are foreseen only for fish sampling.

**France:** a) Monitoring programmes under public consultation: For D8, assessment of contaminants covers four monitoring sub-programmes i) contaminants in the marine biota, ii) contaminants in the marine environment (sediments and water), iii) contaminant effects in marine organisms, and iv) acute pollution events. b) Discussion of the Revision Commission Decision. c) Preparation of the response to Article 12. Periodic fishery cruises under D3, which can provide biota samples for analysis of contaminants under D8. Sampling of sediment every 1/6 years. There are research projects which determine metals, POPs and PAHs in deep sediments and some of these elements and compounds in deep sea sharks. Using of existing monitoring network stations with additional sampling for offshore waters.

**Germany:** Not much considerations on deep sea. There are two stations for collecting deep sediments in the North Sea. Research on marine mammals.

**Ireland:** a) Working on drafting the monitoring programmes: For D8, monitoring will be risk based with the primary focus on coastal areas and alignment in terms of substances with WFD (water) and OSPAR (molluscs, sediments). At present, imposex is the sole biological effect parameter proposed for monitoring. There is a gap on how to sample higher trophic levels. b) Comments to Article 12.

Intends to develop a single monitoring programme for substances in the marine environment to address WFD, OSPAR and MSFD requirements in a more coherent and aligned approach. A risk-based approach dictates primarily inshore monitoring but any offshore monitoring would probably utilise passive sampler deployment and possibly add a focus on biota at higher trophic levels.

**Italy:** a) Preparation of monitoring programmes for the three Mediterranean subregions, taking into account the weak points, particularly quantitative aspects, of GES and targets, as suggested by Art. 12 Assessment. For D8 there will be subprogrammes on assessment of contaminants in water, sediments, and biota and contaminant effects on biota. b) GES and targets will be converted to legislation.

Trying to fill the gaps in open seas.

**The Netherlands:** Monitoring programmes decided. Monitoring is mainly risk-based, for D8 in the coastal waters in alignment with WFD and OSPAR Common indicators for sediment and biota. Focus on imposex to monitor biological effects and the monitoring of fish diseases and PAH metabolites in

fish bile. Exploring the possibilities of combining the current food safety monitoring programme at sea (D9) and the environmental monitoring programme (D8).

No deep sea to be considered.

Norway: Alignment with WFD, and probably also with MSFD, though Norway does not implement the MSFD. Arctic issues to be addressed through OSPAR/AMAP.

Romania: Monitoring programmes under public consultation. For D8, concentrations of contaminants (heavy metals, OCP, PCB, TPH, PAH) are measured by NIMRD in all relevant matrices: water, sediment and biota (mussels, snails, and fish), taking into account EQS (water), EAC/OSPAR (sediments, biota), ERL (sediments). Periodic fishery cruises under D3, which can provide biota samples for analysis of contaminants under D8 and D9. Contaminant effects (in term of bioaccumulation in biota) are included. Monitoring of other biological effects (biomarkers of pollution, such as metallothioneine, vitellogenin content, catalase, SOD, acetylcholin esterase) is under early stages of development. Existing monitoring is performed by NIMRD on national marine waters (transitional /Danube influenced area, coastal /hot-spots, and open sea/ up to 30-40 nm from baseline). Long-term contaminants data from this network to determine trends are available. Offshore data are available from other projects.

Spain: Monitoring programmes soon under public consultation: For D8, two integrative monitoring programmes will be developed, one for coastal waters and offshore waters, taking into account the WFD and RSCs (OSPAR and Barcelona Convention) (mussels, fish and sediments).

Maximum depths for sediment sampling in Atlantic and in Mediterranean were 500 m. Red mullet covered part of the open waters in Mediterranean and they are considering the inclusion of dogfish or other species in Atlantic areas. In the Mediterranean, programmes are based on coastal species and it would be necessary to identify and sample representative deeper species. Using fixed stations (OSPAR/MEDPOL) to determine trends. Improving of spatial coverage, especially in Mediterranean areas because the higher frequency sampling was developed in higher impacted areas (hotspots).

Sweden: MSFD monitoring programme has been published and reported. For D8 the monitoring programme covers activities and pressures, and status (concentrations in biota and sediment and effects). The aim is to use as a minimum those common/core indicators (substances/effect methods) under development in HELCOM and OSPAR. The monitoring conforms with RSCs coordinated monitoring programmes. Taking into account some planned development the monitoring is considered as sufficient to inform the upcoming assessment in 2018.

United Kingdom: Broad monitoring programmes have been consulted upon: For D8 this is risk-based and mainly related to OSPAR common indicators. A good description of UK marine monitoring can be found at the UKDMOS (UK Directory of Marine Observing Systems) website. This includes monitoring that is not MSFD-related. For D8, the relevant programme is the Clean Safe Seas Environment Monitoring Programme (CSEMP). The entries in UKDMOS are being updated but will not include work relating to acute spills, which are one-off studies. The detailed descriptions of the sub-programmes are not yet decided. The substances will be WFD PSs for water in coastal waters (<1 nm) and OSPAR Common indicators for sediments and biota. Effects will be imposex, and some of the OSPAR candidate common indicators (e.g. fish disease, micronucleus), related to the OSPAR MIME working group. An inventory of shipping accidents is held by the Marine Accident Investigation Branch of the Department for Transport and there are the PREMIAM guidelines on monitoring in the event of a spill of oil or chemicals.

OSPAR data are the baseline data. Limited open/deep-sea sampling in England/Wales/Northern Ireland because high risks are not expected. In Scotland, there is a research project on deep-sea fish

populations including analysis of POPs. In the North Sea, some limited sampling offshore to determine contaminants and their effects. Sediments randomly sampled from within geographic strata in offshore areas or from fixed sites in inshore areas.

## PART II: CONCLUSIONS AND RECOMMENDATIONS

After completion of the information compilation, a questionnaire with specific questions on the main issues identified was circulated among experts and the outcome was analysed and discussed in the second working meeting of the MSFD Expert Network on Contaminants. Based on these findings and discussions, this section compiles and presents the final conclusions and recommendations derived from the review process, including the reasoning behind the recommendations and the proposed way forward.

### 5. GES criteria (in accordance with Art. 9.3)

#### 5.1 Conclusions on the use of the existing Decision criteria and indicators

The basic structure of the Descriptor 8 is proposed to be retained, although some modifications are suggested based on the discussions during the review process and in order to clearly differentiate between the assessment of pressure and the assessment of impacts.

#### **Concentration of Contaminants (8.1)**

##### **Concentration of Contaminants and their trends (8.1.1)**

**Recommendation 1:** Establish an EU-wide minimum list of elements and/or parameters for assessing GES, based on:

- WFD Priority Substances (including amendments).
- A clear and justified mechanism for excluding WFD priority substances from MSFD assessments where they are not relevant in the marine environment.
- Other substances (marine region specific substances (selected through RSC mechanisms), or river basin specific pollutants) that might be relevant and would need to be monitored.

**Recommendation 2:** GES threshold values are the WFD EQS. In absence of EQS for specific substances and/or matrices other than those specified under Directive 2000/60/EC, MS could apply other assessment criteria such as those developed by Member States at national level or within RSC, provided they offer the same level of protection as the WFD EQS.

**Recommendation 3:** Member States shall also monitor trends in concentrations of contaminants.

##### **Acute Pollution events (8.1.2)**

**Recommendation 4:** The occurrence, source and spatial/geographical extent of significant acute pollution events involve assessment of pressure and therefore, it is recommended to include this part as a new indicator of pressure and separate it from the effects caused by this pollution.

**Recommendation 5:** Establish an EU-wide minimum list of elements and/or parameters for assessing GES for acute pollution events:

- Number and extent of petroleum/oil related (hydrocarbons) and analogous oil compounds (paraffin, vegetable oils) slicks.

## **Effects of contaminants (8.2)**

### **Biological effects (8.2.1)**

**Recommendation 6:** Methods may currently be regionally different but shall be selected at regional level.

### **Acute Pollution events (8.2.2)**

**Recommendation 7:** Member States shall assess the significance of the impact of acute pollution events.

## **Tentative revised Commission Decision text taking into account the above recommendations**

*There is not final agreement among experts on specific wording. Therefore, further discussions are needed in the eventual revision of the Commission decision text.*

*Descriptor 8: Concentrations of contaminants are at levels not giving rise to pollution effects.*

### *8.1. Concentration of contaminants*

*— Concentration of contaminants and their trends, measured in the relevant matrix (such as biota, sediment and water) in a way that ensures comparability with the assessments under Directive 2000/60/EC (8.1.1)*

*The Member States shall consider the substances or groups of substances, that:*

*(i) are listed as priority substances in Annex X to Directive 2000/60/EC and further regulated in Directive 2013/39/EU and further amendments, where relevant for the marine environment; and/or*

*(ii) are contaminants (chemical and radiological) and their total releases (including losses, discharges or emissions) which may entail significant risks to the marine environment from past and present pollution in the marine region, sub-region or subdivision concerned, including as a consequence of acute pollution events involving for instance hazardous and noxious substances.*

*— Occurrence, source (where possible), spatial/geographical extent of significant acute pollution events caused by crude oil and similar compounds (8.1.2)*

### *8.2. Effects of contaminants*

*The Member States shall consider monitoring:*



- Contaminant-related adverse effects on biological responses at or below individual level in the target species in the region, sub-region or subdivision concerned (8.2.1)
- Significance of the impact on biota affected by acute pollution events caused by crude oil and similar compounds (8.2.2).

## 6. GES methodological standards (in accordance with Art. 9.3)

### 6.1 Aggregation rules

**Recommendation 8:** Aggregation across criteria and across quality elements (contaminants, matrices) should be set through common guidance.

## 7. Specifications and standardized methods for monitoring and assessment (in accordance with Art. 11(4))

### 7.1 Specifications on methods for monitoring

#### 7.1.1 Collection of data

**Recommendation 9:** Member States should select the appropriate matrix (biota, water, sediments) for the assessment of GES for D8. MSFD should align with WFD developments. When adequate sampling and analysis techniques are present, water is a relevant matrix.

**Recommendation 10:** Migratory fish, marine mammals and seabird eggs are relevant for the assessment of GES for D8, but they should not be included as minimum elements and/or parameters.

**Recommendation 11:** The applicability to MSFD of available sampling guidelines developed under WFD and RSCs must be verified.

**Recommendation 12:** Common understanding on the consideration of the Open Sea and Deep Sea Environment is required.

#### 7.1.2 Data quality requirements

**Recommendation 13:** Where appropriate, the Commission Decision should refer to the requirements of Directive 2009/90/EC.

**Recommendation 14:** The applicability of existing European/international standards at EU level should be verified.

### 7.2 Specification on methods for assessment

#### 7.2.1 Scales

**Recommendation 15:** The approaches developed within RSCs could be followed to ensure consistency in the selection of the scale (region, sub-region, subdivision, national, local) at which representativity can be achieved adequately.

## 8. Rational and technical background for proposed revision

### 8.1 Justification and technical background justifying the above recommendations

#### **Explanation for Recommendation 1**

The MSFD programme should be built upon existing networks under other Directives, particularly the Directive 2000/60/EC (WFD) and its amendments. The WFD provides for measures against chemical pollution of surface waters, including two components: (EU)-wide concern substances (priority substances, WFD PS) in coastal and territorial waters (< 12nm) and substances of national or local concern (river basin specific pollutants, RBSP) selected by Member States for control at the relevant level (<1 nm).

The WFD defines:

“Coastal water’ as surface water on the landward side of a line, every point of which is at a distance of one nautical mile on the seaward side from the nearest point of the baseline from which the breadth of territorial waters is measured, extending where appropriate up to the outer limit of transitional waters.”

“Territorial waters’ are the breadth of waters extending out to 12 nautical miles from the baseline defined under the United Nations Convention on the Law of the Sea, 1982.”

By protecting these surface waters, the WFD contributes to the protection of MSFD 'marine waters'.

The Commission Decision should not be prescriptive of substances, but of approach. Under MSFD, Member States shall consider:

- 1) **WFD Priority Substances (WFD PS).** However, some WFD PS might not be relevant for the marine environment and, consequently, should not be necessarily assessed in the marine environment (including coastal waters). Therefore, Member States can exclude the non-relevant WFD PS for their own situation. The WFD PS exclusion process has to be clearly documented and justified, based on predefined situations:
  - Chemical/ physical properties of the contaminant (e.g. volatility and persistence in the marine environment).
  - Monitoring data evidence.
  - Significance of sources and inputs
- 2) **Pollutants relevant at regional level (Marine Region Specific Contaminants),** selected on the basis of the information and knowledge gathered and approaches developed in Regional Sea Conventions (RSCs). The RSC reference lists of priority substances are available (OSPAR-CEMP, HELCOM- Baltic Sea Action Plan (BSAP), Barcelona Convention- UNEP MAP). The RSC priority substances lists largely overlap with the WFD PS list, but also include other contaminants specifically relevant for the marine environment and are not part of the WFD list (see the attached up-to-date draft joint list of RSC substances lists). The selection of regional contaminants relevant for marine monitoring and assessment is reflected in the regional indicators for hazardous substances:

OSPAR Common Indicators on contaminants and biological effects are proposed by the OSPAR Working Groups on Monitoring and on Trends and Effects of Substances in the Marine Environment (MIME) and adopted (or otherwise) by the Hazardous Substances and

Eutrophication Committee (HASEC). Candidate indicators in OSPAR are still under investigation, and will be only adopted if sufficient Contracting Parties agree that they are fit for purpose, and can be taken up in joint OSPAR monitoring programmes.

The substances of special concern for the Baltic Sea Region in the frame work of the Baltic Sea Action Plan as well as the core indicators agreed on in the HELCOM projects CORESET I and CORESET II are selected based on expert assessment taking into account the results of HELCOM thematic assessment on hazardous substances and the WFD priority substances list. HELCOM is developing a set of core indicators as a basis for assessments of the status of the environment. The indicators do not cover all the substances of specific concern. The core indicators will be the focus of HELCOM work on hazardous substances in the near future and form the basis for assessments of the status of the environment. The 'core set' is relevant to all HELCOM Contracting Parties and is assumed to provide a relevant evaluation of the status of the environment. Core indicators are adopted by the highest decision making bodies in HELCOM.

In the Mediterranean, the Barcelona Convention in collaboration with UNEP, a Mediterranean expert consultation on monitoring, including Contaminants (CORMON) has been recently established.

#### Considerations:

River Basin Specific Pollutants (RBSP) are considered under WFD in the transitional waters and coastal waters (1 nm). There might be a provision to make a RBSP EQS non-compliance trigger further investigation in marine waters.

Legacy pollutants are present in the marine environment. Their basic monitoring and assessment is needed to assess GES, even if direct mitigation measures cannot be provided.

Radionuclides are monitored in the marine environment through different programmes (HELCOM MORSE Expert Group, OSPAR Radioactive Substances Committee, MS specific programmes), with the main goal of human protection. At a European level, standards have been laid down for radioactive substances (e.g. in Council Regulation (EURATOM) no. 3954/87 of 22 December 1987). Overall it is assumed that little risk is related to the presence of radionuclides in the marine environment, but updated baseline information is required. On the basis of Article 8, radionuclides must be considered contaminants in the meaning of the MSFD. The following aspects need to be considered:

- 1) Radionuclides must be addressed in the framework of Articles 8, 9 and 10. However, the setting of GES and environmental targets for contaminants is only necessary where "there total releases (...) may entail significant risks to the marine environment from past and present pollution (...)". This consideration of radionuclides in the MSFD must be based, whenever possible, on the assessments carried out for those radionuclides in the context of provisions of the EURATOM Treaty, and any GES and environmental target must be compatible with these provisions.
- 2) The same applies for the implementation of Article 11, for which MS must take into account radionuclides in the monitoring programmes taking into account how radionuclides have been considered in the context of the Articles 8, 9 and 10 MSFD but with due consideration of the monitoring established and carried out under the EURATOM Treaty, in particular Articles 35 and 36 thereof.

- 3) The establishment of measures already covered by the EURATOM Treaty is not necessary under the MSFD and must therefore not be addressed in the context of Article 13 MSFD (see recital 39).
- 4) The work of the Regional Sea Conventions on radionuclides should be used, as much as possible, as a basis for the implementation of the MSFD.
- 5) Consistency between the provisions of the MSFD and the EURATOM Treaty should be promoted to the maximum possible extent.

### ***Explanation for Recommendation 2***

GES threshold values are the WFD EQS, which provides comparability with the assessments under Directive 2000/60/EC.

The selection of contaminants to be monitored under Descriptor 8 should be generally complemented by the selection of the appropriate matrix for monitoring (water, biota, and sediments). For WFD PS, this currently implies mainly water as the explicit environmental compartment to be monitored.

When there are no available EQS, the national standards established by Member States for sediment and/or biota, e.g. based on WFD QS, could also be applied if they offer at least the same level of protection as the EQS for water.

The assessment criteria developed in RSC might be used for MSFD in order to provide additional tools for GES assessment when EQSs are not available. However, it should be kept in mind that the scope of RSC criteria can be different from EQS.

### ***Explanation for Recommendation 3***

The WFD provisions require both the achievement of particular standards, and the identification and reversal of significant and sustained upward trends in the concentration of pollutants.

Under MSFD, Member States shall also monitor trends in contaminant concentrations in order to:

- 1) Identify risks of failing to achieve Good Environmental Status (GES) for substances (measured in the relevant matrix) for which Environmental Quality Standards (EQSs) have not yet been set at the European level.
- 2) Prevent further deterioration of their marine environments, in line with Art. 14.4 MSFD and WFD.
- 3) Provide an early warning in case of concentrations still being below EQS but with an upward trend.
- 4) Assess the effectiveness of measures to control pollution.

The specifications for comparable trend assessment and monitoring under MSFD should include the selection of the appropriate matrix for trend monitoring, the spatial variability and the monitoring frequency to assess reliable trends, the appropriate statistical method for trend assessment, the

determination of the minimum requirements for calculation, and the determination of the acceptable limits before a significant upward trend needs to be reverted.

The WFD provides some guidelines for trend assessment and monitoring (e.g. Technical Report No. 1 prepared by CIS Working Group 2.8, WFD CIS Guidance Documents No. 7, No. 18, No. 25, and No. 32). Guidance is also available within the OSPAR Co-ordinated Environmental Monitoring Programme (CEMP) and at the COMBINE programme of HELCOM.

#### ***Explanation for Recommendation 4***

There is a clear difference between criterion 8.1 “Concentration of contaminants” and criterion 8.2 “Effect of contaminants”, i.e., pressure and impacts. The concentration of contaminants provides the information about the presence of a certain contaminant in the marine environment that might cause effects on marine organisms or human health. The effect of contaminants provides information on the exposure and impact of contaminants (including mixtures) on marine organisms and can respond to contaminants which are not determined chemically.

Therefore, the occurrence, source and extent of acute pollution events should be included in the first part of the descriptor (assessment of pressure) and be separated from the assessment of their effects.

#### ***Explanation for Recommendation 5***

“Acute Pollution Event” implies short time and severe pollution: It can be deliberate or accidental. Therefore, the sampling sites cannot be selected in advance, and the establishment of environmental targets is not possible. EMSA provides oil spill satellite surveillance to the EU coastal states. National aerial and vessel surveillance patrols can then target the area to verify the possible spill and potentially identify the polluter. This communication and verification process can be triggered through the Commission Decision. The EU-wide minimum list of elements and/or parameters for assessing GES proposed for acute pollution events are the number and extent of petroleum/oil related (hydrocarbons) and analogous oil compounds (paraffin, vegetable oils) slicks, and the reporting units would be based on obligations for reporting under national registers. Other chemical’s spills might be difficult to monitor (no visual identification), unless very obvious (e.g. from a shipwreck). Moreover, if the chemical spill is big enough and long-term enough, the substance would be covered under 8.1 and their toxic effects under 8.2.1.

Furthermore, minor frequent spills result in chronic pollution and, therefore they would be covered by 8.2.1.

#### ***Explanation for Recommendations 6***

The assessment of biological effects is crucial for MSFD; they have the potential to provide signals on the health of the ecosystem and will trigger further research to identify problems and substances associated. Biological effects methods can be useful:

- as a screen to judge whether an area is subject to pollution, the nature of which is then investigated;

- to judge whether environmental protection standards/controls (based on information derived under controlled-laboratory conditions) are over- or under- protective of organisms in the real environment;
- to provide assurance that there are no cumulative impacts occurring, e.g. in an area where several substances are close to EQS levels, or where there are multiple known inputs;
- to assess whether an area is actually adversely impacted when there are EQS failures.

However, there is currently no EU-wide list of set minimum required methods for 8.2.1 and there are difficulties in the harmonized application of biological effects methods throughout Europe. The current scientific development (ICES/OSPAR, MEDPOL...) is not mature enough to recommend it as an EU-wide minimum list of elements and/or parameters for assessing GES. Therefore, the Commission Decision should leave the selection of available methods (harmonization and obligations through RSC work) open for Member States as a voluntary and complementary tool to investigate into diffuse problems. Coherence among regions and between MSFD/WFD should be ensured. Guidance on biological effects is available (WFD compilation, ICES) and has been mainly developed in the inshore area.

#### ***Explanation for Recommendation 7***

The assessment of impacts on biota affected by oil and analogous compounds is necessary to evaluate the impacts of acute pollution events. However, the mechanism and the way to address this issue have yet to be determined. The monitoring of beached birds, as indicators of marine oil pollution as developed under OSPAR, cannot be widely used due to the survey logistics and therefore should not be included in the minimum list of elements and/or parameters for assessing GES at EU level.

#### ***Explanation for Recommendation 8***

Aggregation rules are key. The available guidelines on aggregation methods (ICES integrated monitoring guidelines, DELTARES...) provide a possible mechanism for integrating multiple determinants in a common assessment framework and could be also applied for MSFD. However, consideration should be given as to whether to assess the different geographical areas (coastal/territorial waters, continental shelf and open seas areas) separately, as this gives a closer relationship to the measures required to achieve GES.

#### ***Explanation for Recommendation 9***

There is no reason to exclude a priori any applicable matrix (biota, water, sediments) for the assessment of GES for D8. Coherence with WFD is required. When adequate sampling and analysis techniques are present, water is a relevant matrix, but with a lower spatial and temporary representativity than other matrices in coastal areas. For biota and sediment similar arguments are valid.

#### ***Explanation for Recommendation 10***

Migratory fish, marine mammals and seabirds bioaccumulate contaminants and have high concentrations, but they do not match WFD criteria in the sense that EQS derivation considers a

different scenario (WFD EQS biota refer to fish or lower trophic levels), so they might not be effective for deriving measures. However, they may be informative on the ecosystem health status of larger marine areas and can be needed for the assessment of GES by Member States at regional/European geographical scale. Moreover, these species can also provide information about potential risks associated with bioaccumulation.

It is important to consider the spatial representativeness of the monitored species. The interpretation of results would require the knowledge of migratory patterns, or the use of alternate biota matrices (e.g. mammals) as integrative matrices to provide a broader picture of the contaminant status in a region or seabird eggs for trend assessments. There are available guidelines for the establishment of the area of migratory species (ICES).

#### ***Explanation for Recommendation 11***

There are comprehensive and widely applied guidelines addressing sampling strategies developed under WFD and RSCs, and their applicability for MSFD purposes should be verified:

For sediments, the OSPAR “JAMP Guidelines for Monitoring Contaminants in Sediments” (OSPAR agreement 2002-16), ICES Advice 2013, book 1, 1.5.6.8 on the “Spatial design of a regional monitoring programme for contaminants in sediment”, the WFD CIS Guidance document No. 25, might be also applicable to MSFD.

For biota, the sampling strategy must take into account not only the species but also the organ/tissue analysed and the frequency and seasonality of when biota should be sampled in order to minimize natural variability. Guidelines for sampling biota are also already available in RSCs, such as OSPAR, and there are also integrated guidelines (Davies and Vethaak, 2012, ICES advice, 2013, WFD CIS Guidance document No. 25, No. 32).

Passive sampling is an innovative sampling technique and guidelines exist or are under development. Passive sampling has significant potential for future application for MSFD, but so far its use is limited, and recommended only for hydrophobic compounds in water or sediment, or metals in water.

#### ***Explanation for Recommendation 12***

Open/deep-sea areas are the least considered areas. Most monitoring activities are carried out in the coastal area and there is no different strategy or specific approach for the open sea and deep sea environment. Therefore, a major challenge for the implementation of the MSFD is the consideration of these areas.

The lack of specific monitoring in open/deep-sea areas has been often related to the fact that there is little risk in these areas (apart from that coming from specific activities such as oil platforms). However, results from research monitoring have evidenced very high concentrations of contaminants in deep-sea living organisms (e.g. Koenig et al., 2013, HERMIONE project). Biota in deep seas tend to be long-lived and thus more susceptible to bioaccumulation of contaminants, many are also of high trophic level making them susceptible to biomagnification. Consequently, coverage and monitoring in these areas is needed for an appropriate assessment of the state of the

environment. Harmonization of selected species/matrices at regional or sub-regional level should be desirable, as a way to get comparable data.

A clear understanding of what open/deep-sea areas refer to is needed. For example, it should be clarified that open seas can be shallow and deep-sea areas (400 m+) may exist relatively near-shore, i.e., within the area covered by WFD (e.g. in Southern Europe 2000 m water depth at 5 nm from the coastline). The ecosystem is different between deep water and surface waters in the same area; surface waters and deep waters should be considered separately, even in the same location.

**Explanation for Recommendation 13**

According the QA/QC Directive (2009/90/EC) “The quality and comparability of analytical results generated by laboratories appointed by competent authorities of the Member States to perform water chemical monitoring pursuant to Article 8 of Directive 2000/60/EC should be ensured”.

The QA/QC Directive should be applied to MSFD contaminant concentration monitoring in the same way as for contaminant concentration monitoring under the WFD.

**Explanation for Recommendation 14**

The network on WFD proficiency test providers does not exist any longer. A survey on available water, biota and sediment matrix Certified Reference Materials (CRMs) for the 33 WFD Priority Substances (and the 8 "other certain pollutants") was published in 2012 (Richi et al., 2012).

There are also international quality assurance programmes for chemical and biological effects monitoring (e.g. QUASIMEME, BEQUALM, IAEA, from RSCs are available for the most common pollutants in marine sediment and biota). Data used for MSFD assessments at EU level should follow common quality standards. Requirements under the MSFD would drive the development of regular and routine proficiency test exercises.

**Explanation for Recommendation 15**

There is ongoing work within RSCs in relation to the selection of the scale level for each indicator. The close collaboration between OSPAR and HELCOM and the contacts with UNEP MAP should allow for a common and harmonized approach at EU level.

9. Other related products

9.1 Proposed way forward for identified issues

Issue	Way forward	Timeline
Exclusion process of WFD PS which are not relevant for the marine environment.	Common guidance needed.	<i>Started/Finalized 2015.</i>
Selection of marine region specific contaminants	Common approach needed.	<i>Started 2015.</i>



through RSC mechanism.	Compilation of up-to date joint list of RSC contaminant lists.	
WFD EQSs for the marine environment (development of EQSs for other matrices than total water concentrations, what to do when EQS is lower than the calculated background concentrations).	Exchange of information between the MSFD Expert network on Contaminants and the WFD Chemicals Groups and the RSC groups.	<i>Continuous (Not directly related to the review process).</i>
Technical specifications for comparable trend assessment and monitoring under MSFD.	Guidance needed.	<i>Until 2018.</i>
Applicability of available biological effects methods for WFD/MSFD.	Guidance needed. Communication to WFD CIS WG chemicals.	<i>Until 2018.</i>
Occurrence of acute pollution events.	Common understanding needed. Communication with EMSA.	<i>Until 2018.</i>
Assessment of impacts of acute pollution events on biota.	Discussions within the MSFD Expert Network on Contaminants.	<i>Until 2018.</i>
Significance of minor, frequent spills.	Reference in common understanding document.	<i>To be decided (Not directly related to the review process).</i>
Aggregation rules for different geographical areas (coastal/territorial, continental shelf and open seas).	Common guidance needed.	<i>Started/Finalized 2015.</i>
Applicability of existing sampling guidelines for MSFD purposes.	Verification of applicability of CIS Supplementary Guidance (No 32) on biota monitoring (the Implementation of EQS <sub>biota</sub> ).	<i>Finalized 2015.</i>
Coverage and monitoring of open/deep-seas areas.	Common understanding and guidance needed.	<i>Started 2015.</i>
Technical questions regarding the QA/QC Directive (background values, uncertainty at EQS levels, etc.).	Common understanding needed. Communication to WFD CIS WG chemicals.	<i>Continuous (Not directly related to the review process).</i>
Applicability of existing European/International Standards.	Verification of suitability for MSFD.	<i>Until 2018.</i>

## 10. Reference Documents

- Article 12 Technical Assessment (Milieu Ltd, 2014).
- Common Implementation Strategy for the Water Framework Directive (2000/60/EC). 2001. Technical report n° 1. The EU Water Framework Directive: statistical aspects of the identification of groundwater pollution trends, and aggregation of monitoring results.
- Common Implementation Strategy for the Water Framework Directive (2000/60/EC). 2003. Guidance Document No. 7. Monitoring under the Water Framework Directive. Technical Report - 2010 – 041.

- Common Implementation Strategy for the Water Framework Directive (2000/60/EC). 2009. Guidance Document No. 18 Guidance on groundwater status and trend assessment.
- Common Implementation Strategy for the Water Framework Directive (2000/60/EC). 2010. Guidance Document No. 25 on chemical monitoring of sediment and biota under the Water Framework Directive. Technical Report - 2010 – 041.
- Common Implementation Strategy for the Water Framework Directive (2000/60/EC). 2011. Guidance Document No. 27. Technical Guidance For Deriving Environmental Quality Standards. Technical Report - 2011 – 055.
- Common Implementation Strategy for the Water Framework Directive (2000/60/EC). 2014. Guidance Document No. 32 on biota monitoring (the implementation of EQS<sub>biota</sub>) under the Water Framework Directive. Technical Report - 2014 – 083.
- Common Understanding of (Initial) Assessment, Determination of Good Environmental Status (GES) & Establishment of Environmental Targets (Articles 8, 9 & 10 MSFD), (DG GES, 2014).
- Council Regulation (Euratom) no. 3954/87 of 22 December 1987 laying down maximum permitted levels of radioactive contamination of foodstuffs and of feeding stuffs following a nuclear accident or any other case of radiological emergency (Brussels, 1987).
- Davies, I. M. and Vethaak, A. D. 2012. Integrated marine environmental monitoring of chemicals and their effects. ICES Cooperative Research Report No. 315.
- Deltares, 2014. DG ENV mandated Deltares report “Coherent geographic scales and aggregation rules in assessment and monitoring of Good Environmental Status- Analysis and conceptual phase”.
- Directive 2008/105/EC on Environmental Quality Standards in the field of water policy.
- Directive 2013/39/EU amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy.
- First steps in the implementation of the Marine Strategy Framework Directive - Assessment in accordance with Article 12 of Directive 2008/56/EC, (CSWD, 2014).
- HERMIONE project (Hotspot Ecosystem Research and Man's Impact on European Seas), 2009-2012. EC's seventh framework programme (FP7).
- ICES advice, 2013. OSPAR request on spatial design of a regional monitoring programme for contaminants in sediments.
- In-Depth Assessment of the EU Member States' Submissions for the Marine Strategy Framework Directive under Articles 8, 9 and 10. JRC Scientific and policy reports, Report EUR 26473 EN.
- JAMP, 1998a. JAMP guidelines for general biological effects monitoring. Joint Assessment and Monitoring Programme. OSPAR Commission. 38 pp.
- JAMP, 1998b. JAMP guidelines for contaminant-specific biological effects monitoring. Joint Assessment and Monitoring Programme. OSPAR Commission. 38 pp.
- JAMP, 2007. Guidelines for Contaminant-specific Biological Effects Monitoring (agreement 2008-9). OSPAR Commission.

- Koenig, S., Solé, M, Fernández-Gómez, C., Díez, S. 2013. New insights into mercury bioaccumulation in deep-sea organisms from the NW Mediterranean and their human health implications. *Science of The Total Environment* 442, 329-335.
- Long, E.R., MacDonald, D.D., Smith, S.L., Calder, F.D. 1995. Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments. *Environmental Management* 19, 81-97.
- Martínez-Gómez, C., Vethaak, A. D., Hylland, K., Burgeot, T., Köhler, A., Lyons, B. P., et al. 2010. A guide to toxicity assessment and monitoring effects at lower levels of biological organization following marine oil spills in European waters. *ICES Journal of Marine Science: Journal du Conseil*, fsq017.
- MSFD GES workshop on Eutrophication and Contaminants, October 2012.
- OSPAR, 2009. Agreement on CEMP Assessment Criteria for the QSR 2010. Agreement 2009-2. OSPAR Commission, London.
- OSPAR MSFD Advice Document on Contaminants (OSPAR, 2012).
- Review of Methodological Standards Related to the Marine Strategy Framework Directive Criteria on Good Environmental Status (JRC, 2011).
- Review of the GES Decision 2010/477/EU and MSFD Annex III Approach and outline for the process, (EC- Committee/07/2013/03rev, 2013).
- Ricci, M., Kourtchev, I., Emons, H. 2012. Chemical water monitoring under the Water Framework Directive with Certified Reference Materials. *Trends in analytical chemistry* 36, 47-57. <http://www.journals.elsevier.com/trends-in-analytical-chemistry>.
- Schiedek, D., Sundelin, B., Readman, J.W., Macdonald, R.W. 2007. Interactions between climate change and contaminants. *Marine Pollution Bulletin* 54, 1845–1856.
- Task Group 8 Report, Contaminants and pollution effects (JRC, 2010).
- Wernersson, A.S., Maggi, C., Carere, M. 2014. Technical report on aquatic effect-based monitoring tools. Technical Report 2014–077. Office for Official Publications of the European Communities, Luxembourg.

Europe Direct is a service to help you find answers to your questions about the European Union  
Freephone number (\*): 00 800 6 7 8 9 10 11  
(\* ) Certain mobile telephone operators do not allow access to 00 800 numbers or these calls may be billed.

A great deal of additional information on the European Union is available on the Internet.  
It can be accessed through the Europa server <http://europa.eu>.

How to obtain EU publications

Our publications are available from EU Bookshop (<http://bookshop.europa.eu>),  
where you can place an order with the sales agent of your choice.

The Publications Office has a worldwide network of sales agents.  
You can obtain their contact details by sending a fax to (352) 29 29-42758.

European Commission  
**EUR 27464 EN – Joint Research Centre – Institute for Environment and Sustainability**

**Title: Review of the Commission Decision 2010/477/EU concerning MSFD criteria for assessing Good Environmental Status: Descriptor 8.**

Authors: MSFD Expert Network on Contaminants: Victoria Tornero, Georg Hanke, Andra Oros, Andreja Ramšak, Anja Duffek, Ann-Sofie Wernersson, Antonella Ausili, Chiara Maggi, Craig Robinson, Daniela Tiganus, Dorien ten Hulscher, Evin McGovern, Grozdan Kušpilić, Ivana Ujević, Jacek Tronczynski, Jean-Cedric Reninger, Jaakko Mannio, Jo Foden, Koen Parmentier, Lena Avellan, Lucía Viñas, Nevenka Bihari, Norman Green, Oliver Bajt, Paul Whitehouse, Patrick Roose, Peter Lepom, Robin Law, Stefan Schmolke, Valentina Coatu, Vesna Milun, Víctor León, Victoria Besada.

Acknowledgments for contributions to: Andrea Houben, Andrea Weiss, Christer Larsson, Concepción Martínez-Gómez, Daniel Gonzalez, Dick Vethaak, Dominique Boust, Hervé Thebault, Jean François Chiffolleau, Jessica Hjerpe, Juan A. Campillo, Juan Bellas, Karl Lilja, Maria Linderöth, Marie Aune, Michael Haarich, Thierry Burgeot, Thomas Lang, Tobias Porsbring, Tove Lundeberg, ICES MCWG.

The template for the review was prepared by Milieu Ltd., Belgium.  
The report was prepared by Victoria Tornero (EC JRC).

Luxembourg: Publications Office of the European Union

2015 – 44 pp. – 21.0 x 29.7 cm

EUR – Scientific and Technical Research series – ISSN 1831-9424 (online)

ISBN 978-92-79-51842-3 (PDF)

doi:10.2788/015547

## JRC Mission

As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new methods, tools and standards, and sharing its know-how with the Member States, the scientific community and international partners.

*Serving society*  
*Stimulating innovation*  
*Supporting legislation*

doi:10.2788/015547

ISBN 978-92-79-51842-3

