



POLICY BRIEF

Strengthening the Marine Strategy
Framework Directive to tackle chemical
pollution



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[iMERMAID](#) is an EU-funded project focused on protecting the Mediterranean Sea basin, its sensitive ecosystems and the ecosystem services it provides, which play a crucial role in different socioeconomic activities. It addresses the growing threats of chemical contamination and pollution caused by human activities, with a particular focus on contaminants of emerging concerns. iMERMAID integrates innovative strategies for prevention, monitoring, and remediation technologies, particularly around the Mediterranean Sea. This project builds upon the research and innovation activities of 11 projects.

This third policy brief aims to present iMERMAID recommendations for the revision of the [Marine Strategy Framework Directive](#) (MSFD) as planned in the [Water Resilience Strategy](#) (WRS) and the [European Ocean Pact](#). iMERMAID aligned its recommendations to the water acquis - [Urban Waste Water Treatment Directive](#) (UWWTD), the [Nitrates Directive](#), and the [Water Framework Directive](#) (WFD), to reinforce a *source-to-sea* approach and the coherence of the EU regulatory framework for marine and inland water.

The MSFD serves as the cornerstone of the EU's marine environmental policy, aiming to achieve *Good Environmental Status (GES)* of EU marine waters. However, growing pressures from Contaminants of Emerging Concern (CoECs), microplastics, nutrient discharges, and hazardous substances continue to threaten marine ecosystems, calling for a more integrated, digital, and science-based revision of the Directive.

Recommendations

- Strengthen MSFD Descriptors on Contaminants
- Adopt Ecosystem-Based Risk Indicators
- Mainstream Real-Time Monitoring Technologies
- Promote Cross-Border and Regional Innovation

Towards a Water-Smart MSFD: What can iMERMAID Teach Us?

iMERMAID demonstrates the power of marine-focused innovation to fill long-standing regulatory and monitoring gaps under the MSFD. Integrating digital tools, bioaccumulation insights, and stakeholder collaboration can help transform the MSFD into a more resilient, future-proof, and health-protective directive. The findings from iMERMAID can be clustered in 5 sections:

Advanced Monitoring for CoECs and Metals

iMERMAID deployed sensor boxes capable of real-time, electrochemical detection of CoECs (e.g. PFAS, pharmaceuticals, bisphenol A) and heavy metals (Cd, Pb, Cu) in multiple Mediterranean coastal sites. The sensors enable spatially explicit pollution tracking.

Bioaccumulation & Ecosystem Risk

Bioaccumulation and biomagnification are yet under-assessed as marine pollution challenges. Trophic transfer assessments in the Saronikos Gulf confirmed that PFAS and mercury persist in demersal species, with 75% of PFAS concentration levels exceeding EFSA-proposed Environmental Quality Standard (EQS) thresholds, despite being below seafood safety limits.

Sediment Contamination

Measures against marine litter do not fully account for CoECs. Baseline analyses revealed persistent CoECs in marine sediments, an environmental compartment not yet systematically monitored under MSFD despite its ecological relevance.

Policy Fragmentation

Legal analysis identifies inconsistent EQS values, monitoring frameworks, and reporting frequencies across MSFD, WFD, UWWTD, and the Nitrates Directive, particularly for CoECs, PFAS, and nutrient loads. The WRS and the planned revision of the MSFD aims to overcome this incoherence.

Stakeholder Engagement & Governance

Regional engagement strategies demonstrated the need for multi-level marine governance and tailored communication across scientific, municipal, and industrial stakeholders.

Advancing EU Marine Policy: Recommendations for the MSFD Revision

In addition to facilitating advanced coherence among directives, particularly the UWWTD, WFD, and the Nitrates Directive (for example, through joint reporting on eutrophication trends), iMERMAID established a series of recommendations.

1.1.1 Strengthen MSFD Descriptors on Contaminants

The current MSFD Descriptors, which address *contaminants in the environment and seafood*, should be updated in line with recent scientific insights and technological advances to:

- Include PFAS (eg. TFA) and other CoECs under core contaminant monitoring
- Establish marine-specific EQS, harmonised across directives
- Extend monitoring scope to include sediment-bound pollutants
- Promote cost-effective remediation technologies

To strengthen pollution monitoring in marine areas, we recommend a revision of the MSFD as follows:

- **Descriptor D8: Add PFAS, pharmaceuticals, heavy metals**
- **Descriptor D9: Add Bioaccumulation of CoECs in seafood**
- **Annex I: Expand pollutant list to CoECs**

- Article 13 : encourage the use of decentralised remediation technologies.¹
- Annex V: Add sediment matrices
- Cross-directive EQS: Harmonise with WFD & UWWTD

1.1.2 Adopt Ecosystem-Based Risk Indicators

Traditional chemical monitoring focuses on concentration thresholds in water or sediment, often neglecting trophic transfer, species exposure variability, and cumulative effects across ecosystems. The MSFD lacks sufficient:

- Integration Bioaccumulation & Biomagnification Metrics in MSFD Monitoring
- Support for Marine Ecotoxicology Research for Risk-Based Assessment
- Consideration of latest findings and coherence into National MSFD Reporting Frameworks

To align with the Zero Pollution Action Plan (ZPAP)'s objective to *minimise health and ecosystem exposure* to hazardous chemicals, we recommend a revision of the MSFD as follows:

- **Monitoring Programmes:** include multi-species contaminant data focusing on demersal vs pelagic species; commercial vs non-commercial species, for example
- **Articles 8, 11, 17:** include bioaccumulation trend indicators in
- **Policy Coherence:** Align with the ZPAP and WFD bioindicator tools

1.1.3 Mainstream Real-Time Monitoring Technologies

The MSFD, in its current form, relies mainly on conventional and periodic sampling protocols, often producing data that is spatially and temporally sparse, delayed in availability, and costly to maintain. At the same time, other EU water policies are moving toward early-warning systems, smart sensors, and real-time surveillance monitoring, particularly in pollution-prone or high-risk areas. iMERMAID develops digital tools such as portable electrochemical sensors and cloud-connected dashboards that are ready for wider policy uptake to improve detection, prevention and response to pollution events in coastal and marine environments, as well as at the source of pollution (e.g. WWTP).

To modernise marine environmental monitoring with a *source-to-sea* approach, we recommend:

- **Article 11: Integrate Real-Time Sensors into MSFD Monitoring Framework especially for pollution hotspots, vulnerable marine protected areas and Transitional water bodies with known CoEC burdens.**
- **Policy Coherence: Foster Interoperability with UWWTD and WFD Monitoring Schemes through data exchange and dashboard integration particularly for coastal areas.**
- **Regional cooperation: Leverage regional marine partnerships (e.g. under MSFD Regional Sea Conventions) particularly to build local capacity for maintenance and interpretation.**

¹ The microfluidic photocatalytic reactors offer a targeted, point-of-source removal method for such contaminants before they reach marine environments.

1.1.4 Promote Cross-Border and Regional Innovation Uptake

The Mediterranean Sea faces transboundary marine pollution challenges, particularly from persistent organic pollutants, PFAS, and heavy metals originating from urban discharges, port activities, and agricultural runoff. Better transboundary cooperation is needed, particularly in the Mediterranean Sea region.

To maximise the EU's return on marine R&I investment and advance a coherent implementation of the MSFD, Horizon Europe Mission Ocean, and the EU Blue Economy Strategy, we recommend:

- Stimulate in the next Multiannual Financial Framework the upscaling of successful pilots (e.g., pharmaceuticals, PFAS removal)
- Stimulate cooperation with regional marine governance platforms and regional stakeholders such as the Union for Mediterranean Sea and the Committee of Regions associations for the Mediterranean Sea (ARLEM)
- Facilitate integration of project outcomes in data repositories like EMODnet, WISE-Marine, and Copernicus Marine as well as exchange of best practices at regional levels.

To go Further

- iMERMAID, [D1.3: Toolkit for Social Impact](#), May 2024
- iMERMAID, [D2.3: Bioaccumulation and potential for biomagnification of CoEC in Mediterranean Sea Waters](#), May 2025
- iMERMAID, [D3.2: PDP pilot module for remediation of organic CoEC](#), May 2025
- iMERMAID, [D3.3: 4DS Pilot equipment for heavy metal removal from demonstration sites](#), May 2025
- iMERMAID, [D4.1: Requirements and Design of the Use Cases](#), June 2024
- iMERMAID, [D4.2: Benchmarking and Analysis of current aspects, requirements, specifications & conceptual architecture](#), January 2024
- iMERMAID, [D5.1: White paper on upstream solutions](#), May 2024
- iMERMAID, [D5.2: Modelled Scalability of Solutions](#), November 2024



The Mediterranean Sea and its surrounding regions support a diverse variety of essential socioeconomic activities. It is one of the highly exploited water ways and the influence of anthropogenic activities on its marine habitats and ecosystems has grown significantly since the industrial revolution. Because of this, the Mediterranean Sea basin is very vulnerable to chemical contamination and build-up. To safeguard the Mediterranean Sea basin from contaminants for emerging concerns (CoEC), iMERMAID will integrate, coordinate, and synergize innovative preventive, monitoring, and remediation solutions. iMERMAID will build an evidence-based multidimensional framework that will guide policymaking and transform societal perceptions to reduce CoEC usage, emissions, and pollution. Furthermore, next generation sensor and remediation solutions will be developed within iMERMAID to monitor and remove prioritized chemicals from its source while reducing upstream pollution. iMERMAID builds an ideal interdisciplinary team by bringing together prominent SMEs, researchers, regulators, and innovation professionals who have been essential in improving the knowledge and awareness of CoEC. Beyond state-of-the-art techniques, iMERMAID will strive to strengthen regulations against CoEC, expand economic possibilities and competitiveness, improve the standard of living for EU residents, while preventing the accumulation of chemical pollution in the Mediterranean Sea basin. iMERMAID will empower the efforts to create a zero pollution, contaminant free waters by enabling the Chemical Strategy's goals to become a practical reality.



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