Revision of the Water Framework Directive – Call for evidence

The French National Centre for Scientific Research (CNRS) is Europe's leading research-performing organisation, recognised for its excellence in fundamental and applied science and for its contribution to advancing knowledge in support of public policy and societal challenges. Through its multidisciplinary expertise, including in hydrology, ecology, geochemistry, environmental law and socio-ecological systems, the CNRS contributes to a robust scientific understanding of water systems and their interactions with climate, biodiversity and human activities.

The CNRS takes note of the European Commission's initiative to undertake a targeted revision of the Water Framework Directive (WFD), the cornerstone of EU water policy. Over the past two decades, the Directive has established a comprehensive and scientifically grounded framework for the protection and management of water resources, notably through its river basin approach and its objective of achieving good ecological and chemical status. Current scientific and policy evidence converges on a central conclusion: the primary limitation of the Water Framework Directive lies not in its design, but in persistent and uneven implementation across Member States.

While acknowledging the importance of continuously improving the effectiveness and implementation of EU legislation, the CNRS emphasises, on the basis of consolidated scientific evidence, that current findings primarily point to persistent implementation gaps rather than to fundamental shortcomings in the Directive's objectives. In this context, particular attention should be paid to ensuring that any revision does not weaken its core principles, including the non-deterioration principle and the high level of environmental ambition.

The CNRS therefore considers that this consultation represents an important opportunity to reaffirm the central role of science in informing EU water policy, to strengthen the implementation and integration of the existing framework, and to ensure that future developments are fully aligned with the ecological, climatic and societal challenges embedded within Europe's water systems.

CNRS Contribution

The CNRS considers the WFD as a foundational instrument of the European Union's environmental acquis and a key instrument for ensuring the long-term protection and sustainability of water resources and aquatic ecosystems across Europe. In light of the increasing pressures on aquatic systems and the strategic importance of water for ecological integrity, human health and socio-economic stability, any revision or modification of the Directive requires a robust, evidence-based and scientifically grounded assessment.

In this context, the CNRS emphasises that policy developments affecting the WFD should be informed by the best available scientific knowledge, reflecting the complexity of hydrological systems, the interdependence between water quality and quantity, and the long-term dynamics of ecological processes. Scientific evidence is essential to ensure that regulatory adjustments effectively address existing shortcomings without undermining the Directive's objectives.

In response to the present consultation, the CNRS therefore proposes a structured contribution grounded in scientific expertise. It first provides a factual and consolidated overview of the current state of play, key trends and emerging challenges related to water systems in Europe. It then formulates a set of evidence-based considerations and recommendations aimed at supporting informed and effective policy decision-making.

Overview of the current situation

Policy recognition of water challenges

The European Union has consistently acknowledged, across its strategic and policy frameworks, the urgency and structural nature of water-related challenges. The European Green Deal and the Zero Pollution Action Plan set the objective of reducing pollution to levels no longer harmful to human health and ecosystems by 2050. In parallel, the EU has committed, in line with the UN Water Action Agenda, to accelerating progress towards water-related Sustainable Development Goals. More recently, the 2025 Water Resilience Strategy explicitly recognises that "our current model of managing water is not sustainable" and calls for placing water resilience at the centre of the political agenda.

Implementation gap and environmental outcomes

Despite this high level of political recognition, **the current state of European water bodies reflects persistent and systemic shortcomings**. According to the latest implementation reports, only a limited share of surface waters achieves good ecological and chemical status, with around 40% of surface water bodies in good ecological status (or ecological potential) and less than 30% in good chemical status, with progress remaining insufficient and uneven across Member States. This persistent gap, after more than twenty years of implementation, provides strong evidence that the core challenge lies in enforcement, governance and policy integration rather than in the Directive's design. This gap reflects both implementation deficits and insufficient integration of water objectives into sectoral policies and limited administrative and financial capacity. The missed 2015 deadline and the risk of failing the 2027 target further highlight a systemic implementation gap.

These challenges are compounded by the extensive use of exemptions, derogations and deadline extensions under the Directive, as well as ongoing legal disputes reflecting divergent interpretations across Member States. While the 2019 Fitness Check confirmed the overall fitness of the EU water acquis, it also identified persistent governance and implementation weaknesses.

Scientific understanding of water systems

From a scientific perspective, current knowledge points to the need for an integrated and systemic understanding of water systems. Water quantity and quality are intrinsically interdependent and must be assessed across the entire hydrological cycle, from source to sea. Hydrological connectivity, spatial and temporal variability, and complex interactions between biotic and abiotic components, including soils, climate, and biodiversity, play a determining role in shaping water dynamics and ecosystem responses. These dynamics are increasingly influenced by climate change, which, as documented in IPCC assessments amplifies hydrological variability and extreme events by altering precipitation patterns, increasing evapotranspiration, and intensifying the frequency and severity of droughts and floods.

Scientific evidence also highlights the dominant role of diffuse pollution, notably from agriculture and urban runoff, as a primary driver of water quality degradation, surpassing point-source pollution in many regions and requiring systemic, landscape-scale approaches. In parallel, hydromorphological alterations, such as river fragmentation and flow regulation, remain a major but insufficiently addressed cause of ecological degradation, affecting sediment transport, habitat continuity and ecosystem functioning.

Furthermore, water systems are not static: their current state cannot be considered as a fixed baseline, as they evolve along trajectories shaped by interacting climatic, socio-economic and demographic pressures

Cross-sectoral implications

The socio-economic implications of water degradation are substantial and often underestimated. Water pollution generates significant costs, including increased treatment requirements for drinking water, restrictions on economic uses such as tourism, and broader impacts on ecosystem services and human health. In addition, emerging evidence points to the growing role of water availability and quality as a limiting factor for key sectors, including agriculture, energy production and extractive industries, thereby linking water management directly to the feasibility of broader economic and industrial transformations. At the same time, increasing water scarcity is generating use conflicts, constraining economic development and, in some cases, forcing the reconsideration or abandonment of certain activities.

Recent scientific evidence also demonstrates that reductions in freshwater inflows propagate across the land–sea continuum, affecting coastal and marine ecosystem functioning, including primary productivity and associated fisheries, thereby reinforcing the systemic interdependence between inland water management and marine systems[1].

Beyond its environmental and economic dimensions, water is increasingly recognised as a fundamental societal and legal concern. EU law (WFD) and policy frameworks emphasise that water is not a commercial product like any other, but a heritage that must be protected. It is also associated with access to essential services and, more broadly, with the effective realisation of fundamental rights. In this context, growing pressures on water resources are leading to increasing tensions over allocation between human needs, ecosystems needs and economic uses.

In parallel, recent research indicates that water availability constraints already act as binding limits for certain extractive and industrial systems, with some production levels approaching or exceeding locally sustainable water thresholds, suggesting potential medium-term resource bottlenecks in water-stressed regions[2].

Systemic risks

Taken together, these elements point to a set of critical and interrelated challenges. Aquatic ecosystems are at risk of crossing ecological tipping points, including eutrophication-induced regime shifts, groundwater depletion thresholds, and irreversible alterations of river connectivity, beyond which degradation may become irreversible or extremely costly to reverse. At the same time, there is a structural mismatch between the long-term response times of hydrological and ecological systems and shorter policy and investment cycles. This creates a risk of delayed or insufficient action despite the availability of scientific knowledge.

In this context, ongoing discussions on the revision of the Water Framework Directive must ensure that efforts to simplify legislation do not weaken environmental objectives. Given the current state of water bodies and increasing water stress, maintaining a high level of environmental ambition remains essential to ensure long-term ecological and socio-economic resilience.

These dynamics point to the emergence of a systemic water risk in Europe, where ecological degradation, increasing demand and climate-induced variability interact to create non-linear and potentially irreversible impacts across water, food, energy and health systems.

Recommendations

On the basis of the scientific assessment presented above, the CNRS identifies the following priority areas for strengthening the effectiveness, coherence and resilience of the WFD, focusing in particular on implementation and enforcement, pollution prevention at source, and alignment of water use with ecological limits.

1. Reinforcing science-based policymaking in EU water governance

A central concern raised by the scientific community is not the absence of scientific knowledge, but its insufficient structuring role in EU policymaking. While the Union has repeatedly affirmed the importance of evidence-based regulation, this principle remains unevenly operationalised, particularly in the context of major legislative reviews such as the WFD.

Under Article 191(2) TFEU, environmental policy is explicitly required to be based on scientific and technical data. This creates not only a policy orientation but a legal obligation to ensure that regulatory

[1] Macias, D., Bisselink, B., Carmona-Moreno, C. et al. The overlooked impacts of freshwater scarcity on oceans as evidenced by the Mediterranean Sea. Nat Commun 16, 998 (2025). https://doi.org/10.1038/s41467-024-54979-4

[2] Kamrul Islam et al. ,Geological resource production constrained by regional water availability.Science387,1214-1218(2025).DOI:10.1126/science.adk5318

choices reflect the state of scientific knowledge. However, in practice, robust scientific evidence, sometimes consolidated over decades, as illustrated by research on eutrophication or diffuse pollution, is still insufficiently visible in decision-making processes, or treated as one input among others rather than a structuring basis, which raises concerns both about policy effectiveness and compliance with Article 191(2) TFEU.

This disconnect raises a broader systemic issue: the tendency to under-account for externalities of economic activities, which in turn sustains policy assumptions of decoupling growth from environmental constraints in contexts where ecological systems are finite. It also reflects a structural difficulty in translating complex, long-term scientific evidence into sectoral policy frameworks organised around short-term optimisation logics.

In response, three complementary priorities emerge:

- reinforcing the **legal and operational role of scientific evidence in impact assessments**, particularly for major revisions of environmental legislation;
- ensuring that **cumulative impacts, uncertainties and non-linear ecological responses** are explicitly integrated into regulatory design, including tipping points and delayed ecosystem responses;
- developing **systemic assessment frameworks** capable of overcoming sectoral fragmentation, including nexus and One Health approaches that reflect the interdependence between water, climate, biodiversity and health systems.

In this context, improving the completeness of water status monitoring across Member States is essential, as persistent data gaps undermine risk assessment, comparability and preventive action.

2. Strengthening water quality protection and pollution control

Scientific evidence consistently shows that water systems cannot be effectively managed through fragmented, sectoral approaches. Hydrological systems are characterised by strong interdependencies across spatial and temporal scales, as well as between biotic and abiotic components. Climate change further amplifies these dynamics, acting as a threat multiplier through increased variability and the intensification of extreme events.

Despite this, governance frameworks often remain structured around siloed policy objectives, which limits their capacity to address cumulative pressures. This is particularly evident in relation to diffuse pollution, hydromorphological alterations, and land-use pressures, which interact in ways that are not fully captured by current regulatory instruments.

Strengthening systemic coherence therefore requires:

- fully operationalising a **source-to-sea approach**, including stronger integration between the WFD and the Marine Strategy Framework Directive;
- explicitly accounting for **hydrological connectivity across water bodies**, in line with CJEU case law confirming that impacts on small water bodies can affect larger interconnected systems;
- reinforcing the assessment of **cumulative pressures across catchments**, including land-use, soil degradation and water abstraction.

A more integrated approach is also required to address emerging pollutants and chemical mixtures. Current regulatory frameworks, largely based on single-substance thresholds, are not fully adapted to capture combined exposure effects and ecosystem-level impacts.

3. Securing water availability within ecological and social limits

Beyond quality considerations, the scientific evidence highlights increasing constraints on water availability and renewability, particularly in water-stressed regions. Several Member States already rely on significant storage or abstraction levels, with documented impacts on hydrological regimes, sediment transport and ecosystem functioning. Large-scale river regulation through reservoirs already affects a

substantial share of global river discharge, with storage capacity in some basins approaching annual flows, contributing to major alterations in sediment continuity and downstream geomorphological processes[3].

This raises the need to explicitly align water use with ecological limits at basin scale, taking into account both climate change and broader socio-economic pressures. In particular, scientific findings show that overexploitation of freshwater systems is likely to lead to irreversible regime shifts under sustained pressure, including groundwater depletion and the loss of river continuity.

In this context, the following priorities emerge:

- aligning water use with **basin-scale ecological carrying capacities**, including groundwater systems;
- integrating **climate change and land–sea continuum dynamics**, including downstream impacts on coastal ecosystems and fisheries;
- assessing the **water footprint of industrial, energy and agricultural transitions**, including indirect and life-cycle impacts.

The socio-ecological transition also requires a more explicit consideration of water demand reduction pathways, including efficiency targets consistent with recent EU guidance on water efficiency, as well as basin-level water balance assessments.

This supports a more systematic consideration of quantitative water aspects across Environmental Impact Assessments, river basin management planning, and monitoring and control frameworks. It also points to the value of further **clarifying the concept of water scarcity** and reflecting it more consistently in planning approaches, including through enhanced basin-level water balance assessments and a more structured consideration of water use prioritisation in stressed catchments.

4. Strengthening place-based and multi-level territorial governance

Scientific evidence highlights that effective water governance requires a stronger anchoring in territorial realities, where ecological, social and economic dynamics intersect. River basins and coastal zones constitute the relevant scale to operationalise water–food–energy–health interdependencies and to address spatial inequalities in water availability, quality and resilience.

Despite this, governance frameworks often remain insufficiently adapted to local specificities, limiting their capacity to reflect cumulative pressures, differentiated vulnerabilities and varying adaptive capacities across territories. This gap may reduce both the effectiveness and the social acceptability of water policies.

In addition, growing pressures on water resources are increasingly generating tensions between ecological requirements and socio-economic uses, particularly in regions highly dependent on water-sensitive activities such as tourism or agriculture.

In this context, the following priorities emerge:

- **strengthening place-based and multi-level governance approaches**, ensuring that implementation of EU water policy reflects hydrological, ecological and socio-economic specificities;
- **integrating ecological, social and economic dimensions in territorial planning**, in order to better anticipate trade-offs and cumulative impacts;

- [3] Evan N. Dethier *et al.*,Rapid changes to global river suspended sediment flux by humans.*Science***376**,1447-1452(2022).DOI:10.1126/science.abn7980

- **reinforcing stakeholder involvement and co-construction processes**, as a condition for long-term effectiveness and social acceptability of water policies.

5. Ensuring robust and coherent regulatory instruments

The effective implementation of the WFD relies on the coherence, robustness and proper articulation of the regulatory instruments that support it across the EU environmental acquis.

However, current developments point to increasing tensions between the objectives of simplification, acceleration of permitting procedures and the need to maintain a high level of environmental protection. In particular, ongoing initiatives aimed at streamlining environmental assessment processes raise concerns regarding the capacity of existing frameworks to adequately capture cumulative impacts, long-term ecosystem dynamics and scientific uncertainties.

At the same time, fragmentation between EU legislative instruments continues to limit the effectiveness of pollution prevention and risk assessment. Insufficient coordination between the WFD and other relevant frameworks (including the Habitats Directive, the Marine Strategy Framework Directive, the Industrial Emissions Directive, the Seveso Directive, the Ambient Air Quality Directive and the REACH Regulation) may lead to inconsistencies and gaps in implementation.

In parallel, the increasing reliance on derogations and exemptions under the Directive raises significant concerns. Despite repeated calls to limit their use, several Member States envisage continued or even extensive recourse to these mechanisms in the coming planning cycles. This trend is further reinforced by recent amendments introducing additional flexibility under Article 4(7), while key legal notions, such as “new sustainable human development activities” and “overriding public interest”, remain insufficiently defined, creating a risk of broad and divergent interpretations across Member States and a potential weakening of the non-deterioration principle. This creates a structural risk of progressive weakening of the non-deterioration principle through cumulative and insufficiently controlled exemptions.

The absence of systematic oversight mechanisms at Union level, in particular the lack of prior notification requirements, further limits effective monitoring and consistency of application. Strengthening governance of derogations, including clearer operational criteria and improved control mechanisms at Union level, therefore appears essential.

In this context, the following priorities emerge:

- ensuring that **simplification initiatives do not reduce the scientific robustness** of environmental impact assessments, including by keeping them up to date with scientific and methodological advances, as well as their **scope and procedural guarantees**, in particular with regard to cumulative impacts and long-term dynamics;
- strengthening **coherence and synergies between the WFD and other relevant EU environmental legislation**, in order to improve upstream pollution prevention and risk assessment;
- **promoting the implementation of extended producer responsibility schemes**, particularly for substances covered by water legislation, to contribute to monitoring costs and reinforce prevention at source;
- **reinforcing the governance of derogations**, including through enhanced transparency and justification requirements, clarification of key legal concepts, and improved monitoring and oversight mechanisms at Union level.

Particular attention should also be paid to the preservation of procedural guarantees related to public participation and access to justice. While Article 14 of the WFD provides a basis for stakeholder involvement, its limited binding nature contrasts with more recent developments in EU environmental law and with requirements stemming from the Aarhus Convention and the Charter of Fundamental Rights. In the context of increasing efforts to accelerate environmental assessment procedures, it is essential to ensure that procedural safeguards are fully maintained.

In light of the scientific evidence presented in this contribution, the CNRS considers that this revision should primarily aim to improve implementation, strengthen governance, and address persistent

fragmentation across policy areas, rather than to reconsider the Directive's fundamental objectives. While the CNRS recognises the objective of improving implementation efficiency and addressing specific bottlenecks, such developments should remain fully consistent with the core environmental objectives of the WFD.

The available scientific evidence indicates that Europe's water challenges stem primarily from insufficient implementation and systemic policy fragmentation rather than from deficiencies in the Directive itself.

In this context, any revision that weakens the Directive's core principles would risk exacerbating existing pressures and undermining long-term ecological and socio-economic resilience. Strengthening implementation, coherence and scientific integration should therefore constitute a central objective of this review. Accordingly, simplification measures should focus on procedural efficiency and administrative clarity, without undermining the effectiveness of environmental protection requirements.