The Water Forum - An Fóram Uisce

Water Quality of Transitional and Coastal Waters

Policy Recommendations for Policy Alignment and Improved Integrated Catchment and Coastal Management

A report produced for An Fóram Uisce

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Project reference: Transitional and Coastal Waters – Policy Recommendations for improved policy alignment and integrated catchment and coastal management

Date of issue: 12 January 2026

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Report should be cited as: AQUAFACT (2026) Water Quality of Transitional and Coastal Waters - Policy Recommendations for Policy Alignment and Improved Integrated Catchment and Coastal Management

Revision and Amendment Register

Version Number	Date	Summary of Changes	Approved by
1.0	03/11/2011	First Draft	Dr Eddie McCormack
2.0	09/12/2025	Final Daft	Dr Eddie McCormack
3.0	12/01/2026	Final Report	Dr Eddie McCormack

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1. Introduction

Ireland's transitional and coastal waters are among its most ecologically diverse and economically valuable natural assets. These waters support a rich biodiversity, provide essential ecosystem services, and underpin key sectors such as fisheries, tourism, and maritime transport. However, they are increasingly subject to pressures from human activities, climate change, and fragmented governance structures. The complexity of managing these waters arises from the interplay of multiple European and national policies, each with distinct objectives, geographic scopes, and implementation mechanisms. Addressing these challenges requires a more integrated and coherent approach to catchment and coastal management, informed by robust scientific evidence and policy analysis.

1.1 Purpose of the Report

This report has been commissioned by the Water Forum (An Fóram Uisce) to provide policy recommendations aimed at improving the alignment of existing legislative frameworks and enhancing the integration of catchment and coastal management in Ireland. The primary focus of this report will be on the level of interaction between the Water Framework Directive (WFD) and Marine Strategy Framework Directive (MSFD).

Specifically, the report seeks to:

- Present the current ecological status of transitional[1] and coastal waters
- Identify the main pressures affecting these waters
- Describe how these waters are impacted by the process of eutrophication and our current understanding of this phenomenon
- Analyse the interactions and coherence between the Water Framework Directive and the Marine Strategy Framework Directive
- Evaluate the effectiveness of current governance structures and level of policy alignment
- Provide recommendations to support better policy integration and environmental outcomes

The overarching goal is to support the Water Forum in its advisory role by providing evidence-based insights that can inform national policy and planning processes.

1.2 Structure of the Report

The report is structured into four main chapters:

[1] A collective term used in the WFD for estuaries and lagoons influenced by freshwater inputs.

- **Chapter 2** outlines the policy and legislative context, mapping the key directives, frameworks, and governance arrangements that shape the management of transitional and coastal waters.
- **Chapter 3** presents the current ecological status of these waters, identifies the main pressures, and explores trends over time, with a detailed focus on eutrophication and nutrient dynamics.
- **Chapter 4** provides a comparative analysis of the WFD and MSFD, examining their objectives, implementation pathways, monitoring programmes, and governance structures. This chapter also includes a strategic review of their interactions and alignment.
- **Chapter 5** synthesises the findings and sets out policy recommendations to enhance coherence, integration, and effectiveness in managing Ireland's transitional and coastal waters.

2. Policy and Legislative Context

2.1 Introduction

Transitional and coastal waters in Ireland are subject to a complex and evolving policy landscape shaped by both European Union directives and national legislation. These waters are ecologically rich and economically vital, yet increasingly vulnerable to pressures such as pollution, climate change, biodiversity loss, and competing maritime activities. Effective governance and sustainable management require a coordinated approach across multiple sectors and administrative levels.

This chapter outlines the key policies, directives, and governance frameworks that influence the management of transitional and coastal waters in Ireland. It describes the roles of the Water Framework Directive (WFD), Marine Strategy Framework Directive (MSFD), Marine Spatial Planning Directive (MSPD), and the National Marine Planning Framework (NMPF), alongside emerging legislation such as the Nature Restoration Law and Ireland's National Coastal Change Management Strategy. The chapter also highlights the importance of integrated approaches, including Integrated Catchment Management (ICM) and Integrated Coastal Zone Management (ICZM), and the new role of institutions like the Maritime Area Regulatory Authority (MARA) in shaping marine governance.

By mapping out this policy landscape, the chapter aims to provide a comprehensive understanding of the regulatory environment that exists for the management and protection of these waters. In the following chapter, this analysis is taken further by examining the interactions between the WFD and MSFD with the intention of identifying opportunities for improved coordination, integration, and strategic planning in the protection and sustainable use of Ireland's transitional and coastal waters.

2.2 EU Water Framework Directive

The Water Framework Directive (WFD) requires member states to protect and improve water quality in all waters so that Ireland achieves good ecological status by 2027 at the latest, while at the same time preventing deterioration in the existing status of waters. The Directive was given legal effect in Ireland by the European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003). It applies to rivers, lakes, groundwater, transitional and coastal waters out to 1 nautical mile from the baseline from which the extent of territorial waters is measured. The Directive requires that management plans be prepared on a river basin basis every 6 years and specifies a structured method for developing these plans. The Department of Housing, Local Government and Heritage (DHLGH) lead the implementation of the WFD in Ireland.

2.3 EU Marine Strategy Framework Directive

The aim of the Marine Strategy Framework Directive (MSFD) is to achieve good environmental status (GES) for the marine waters of the European Union and associated territories. Ireland's marine waters fall into the North-East Atlantic Ocean marine region, one of the four regions included in the Directive. The others being the Baltic Sea, Mediterranean Sea and Black Sea. The spatial extent of the MSFD is shown in Figure 2-1. The MSFD applies to waters, the seabed and subsoil on the seaward side of the baseline extending to the outmost reach of the area where a member state has and/or exercises jurisdictional rights, in accordance with the UN Convention on the Law of the Sea (UNCLOS).

GES is described using 11 state and pressure descriptors which address different components and pressures affecting the marine environment and marine ecosystems. The descriptors are in turn described by criteria and indicators and thresholds that are required to be met if GES is to be achieved. Environmental targets, which can either be state, pressure, impact or operational, have also been developed to guide and facilitate the meeting of these environmental thresholds and consequently GES. These targets, thresholds and indicators form part of the overall marine strategy, along with programmes of monitoring and programmes of measures, which are updated and reviewed on a cyclical basis every 6-years. The responsibility for implementing the MSFD in Ireland now resides with the Department of Climate, Energy and the Environment, having previously been the responsibility of (DHLGH).

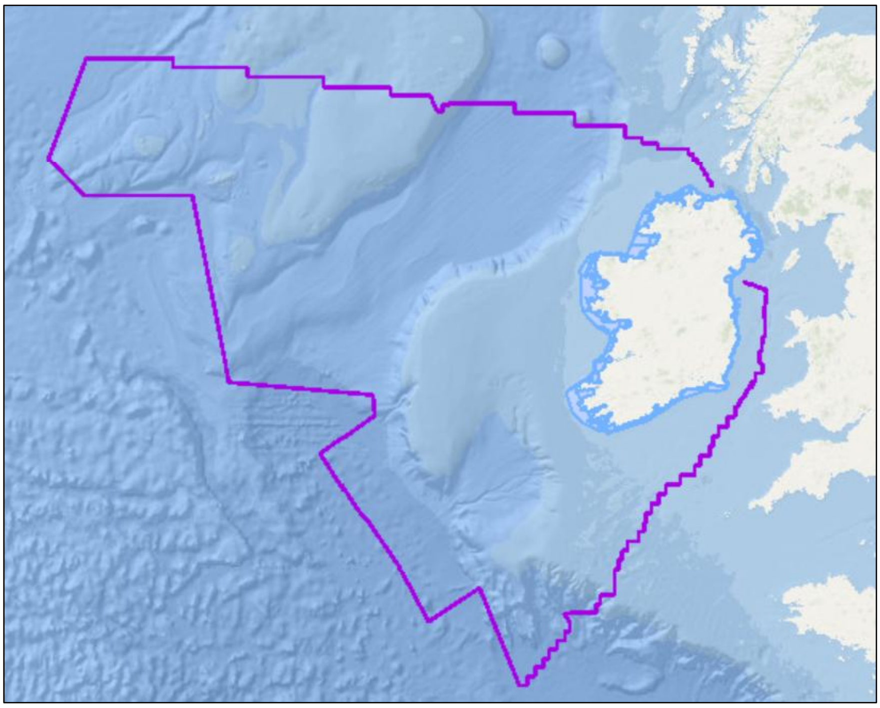

Figure 2-1 Spatial extent of the WFD (blue line) and MSFD (purple line). Source: Ireland's Marine Atlas: atlas.marine.ie

2.4 EU Marine Spatial Planning Directive

The increase in the use of the Europe's maritime environment, not only for the development of offshore renewable energy projects, but for other uses such as aquaculture, maritime transport and other blue economy activities necessitated the need for the introduction of policies on marine spatial planning. The EU Marine Spatial Planning Directive (MSPD) 2024/89/EU sets out a legal requirement for member states to develop and implement national marine spatial plans. The directive provides a framework for "maritime spatial planning aimed at promoting sustainable growth of maritime economies, the sustainable development of marine areas and the sustainable use of marine resources". The Department of Climate, Energy and the Environment lead the implementation of the MSPD.

2.5 National Marine Planning Framework

The National Marine Planning Framework (NMPF) is Ireland's first national marine spatial plan and establishes a blueprint for the development of Ireland's maritime area up to 2040. Its overall aim is to ensure that Ireland's natural marine resources are used in a sustainable way while protecting and conserving their rich marine biodiversity and ecosystem services. The NMPF emphasises the importance of public engagement and environmental protection. The Department of Climate, Energy and the Environment is responsible for the NMPF.

The NMPF highlights the importance of the Marine Strategy Framework Directive and other environmental legislation such as the Birds and Habitats Directives and the Water Framework Directive in ensuring that the natural resources provided by the marine waters surrounding Ireland are sustainably managed.

2.6 Maritime Area Planning Act and MARA

The Maritime Area Planning (MAP) Act 2021 was enacted to ensure the proper implementation of the NMPF. The Act has led to the establishment of a new maritime regulatory authority known as the Maritime Area Regulatory Authority (MARA). This new authority is responsible for issuing Maritime Area Consents (MACs) and Marine Usage Licences and overseeing the establishment of designated marine area plans (DMAPS). Developers of marine infrastructure projects must be granted a MAC before applying for planning permission from An Coimisiún Pleanála (ACP).

2.7 EU Biodiversity Strategy

The EU Biodiversity Strategy for 2030 which aims to put Europe's biodiversity on a path to recovery sets out a commitment to establish an enlarged network of protected areas on land and sea. It sets out to legally protect at a minimum 30% of the sea area in the EU. This target is also consistent with the target set by the OSPAR Convention for the establishment of a network of marine protected areas (MPAs). Ireland's commitment to protect 30% of its marine areas by 2030 will be given legal effect through an amendment to the Maritime Area Planning Act 2021 (MAPA).

2.8 EU Nature Restoration Law

The EU Nature Restoration Law which was recently adopted by the Council of the European Union (2024) sets legal standards for member states to restore 20% of degraded EU land and sea ecosystems by 2030. The restoration efforts mandated by the new Law will prioritise the protected areas designated under the nature Directives. For habitats in 'poor' condition, member states must take measures to restore 30% of them by 2030, 60% by 2040 and 90% by 2050. Member states are also obliged to make efforts to prevent deterioration for areas that are in good condition.

2.9 4th National Biodiversity Action Plan 2023 – 2030

Ireland's 4th National Biodiversity Action Plan (NBAP) 2023–2030 sets out a comprehensive agenda to address the biodiversity crisis through a transformative, inclusive, and science-led approach. It was developed by the National Parks and Wildlife Service (NPWS), the Department of Housing, Local Government and Heritage, with input from the Biodiversity Working Group, the Biodiversity Forum, and extensive public consultation.

2.10 Maritime Area Planning (Marine Protected Areas) (Amendment) Bill

The government is proposing to amend the existing Maritime Area Planning Act 2021 by introducing the Maritime Area Planning (Marine Protected Areas) (Amendment) Bill. This amendment will establish a clear legislative framework for designating and managing Marine Protected Areas (MPAs) within Irish waters. Under the Bill, Ireland aims to protect 30% of its maritime area by 2030, in line with EU and UN biodiversity targets, known as the "30x30" goal.

2.11 OSPAR Convention

The transboundary nature of the marine environment requires a coordinated approach to management across territorial boundaries. Ireland works regionally with 15 other countries in the North-East Atlantic and the European Commission through the OSPAR Convention, through which legally binding actions are agreed and implemented for the protection of the marine environment of the North-East Atlantic. These decisions, recommendations and agreements are collectively known as the OSPAR Acquis. An important component of the MSFD is the requirement it places on member states to cooperate and coordinate their activities through existing regional cooperation structures. It also facilitates cooperation at regional level with non-EU jurisdictions such as the UK.

Responsibility for managing the OSPAR Convention in Ireland now lies with the Department of Climate, Energy and the Environment. This role was previously held by the Department of Housing, Local Government and Heritage (DHLGH), but as of August 1, 2025, marine environment functions, including oversight of the OSPAR Convention, were formally transferred to the Department of Climate, Energy and Environment.

2.12 Integrated Catchment Management

Integrated Catchment Management (ICM) in Ireland is a holistic approach to managing water resources that considers the entire river catchment area, including land use, water quality, biodiversity, and community engagement. It is designed to ensure sustainable water management by integrating environmental, social, and economic factors within each catchment. In Ireland, Integrated Catchment Management is underpinned by the EU Water Framework Directive and Ireland's Water Action Plan 2024, led by the Department of Housing, Local Government and Heritage. The current plan outlines actions for improving water quality and includes ICM as a core strategy through the creation of Catchment Management Work Plans for each catchment which will develop into fully integrated frameworks for managing water quality at the catchment level.

2.13 Integrated Coastal Zone Management

Integrated Coastal Zone Management (ICZM) is a process that brings together all stakeholders involved in the development, management, and conservation of coastal areas. The aims of ICZM are to promote sustainable use of coastal resources by integrating land-sea interactions and considering and addressing conflicts which may arise between different users of the coastal zone.

In Ireland there is no dedicated national ICZM policy in place, but the enactment of the Maritime Area Planning Act and the establishment of the Maritime Area Regulatory Authority (MARA) represents a significant step towards improved integration.

2.14 National Coastal Change Management Strategy

Ireland's National Coastal Management Strategy has been prepared to address the threat of climate change and risk of sea level rise, coastal erosion, increased storm surges and impacts on intertidal zones. It aims to create a **whole-of-government approach** to managing coastal change, ensuring coordinated action across sectors and levels of governance.

The National Coastal Change Management Strategy in Ireland is a collaborative effort led by an interdepartmental steering group, jointly chaired by the Department of Housing, Local Government and Heritage and the Office of Public Works (OPW).

2.15 Climate Action and Low Carbon Development Act

The Climate Action and Low Carbon Development Act is a foundational piece of legislation in Ireland that sets the framework for the country's transition to a low-carbon, climate-resilient, and environmentally sustainable economy by 2050. Under the Act (as amended) the government publishes annual Climate Action Plans that operationalise the national climate objectives set out in the legislation. The annual CAPs provide roadmaps of actions across sectors such as energy, transport and agriculture to reduce greenhouse gases. These are led by the Department of the Climate, Energy and the Environment.

2.16 Other Legislation

Obligations arising under a range of other directives and policies are relevant to the sustainable management of the marine environment and include the Strategic Environmental Assessment Directive, the Environmental Impact Assessment Directive, the Shellfish Waters Directive, the Bathing Water Directive, the Urban Wastewater Treatment Directive, the EU Common Fisheries Policy and the Blue Economy policy.

2.17 Conclusions

Ireland's transitional and coastal waters are governed by a wide array of interconnected policies and directives, each contributing to the overarching goal of ecological protection and sustainable development. While significant progress has been made in establishing frameworks such as the WFD, MSFD, and NMPF, challenges remain in achieving full integration across sectors and scales.

The emergence of new legislation, including the Nature Restoration Law and the Marine Protected Areas Bill, signals a growing commitment to restoring and safeguarding marine ecosystems. However, the absence of a dedicated national ICZM strategy and fragmented governance structures highlight the need for more cohesive and adaptive policy implementation.

To ensure resilient and well-managed coastal and transitional waters, Ireland must continue to strengthen cross-directive coordination, enhance stakeholder engagement, and invest in integrated planning approaches that reflect the dynamic nature of its marine and coastal environments. Chapter 4 of this report provides an analysis which is used to help identify a number of recommendations to improve the level of coordination and cohesion between the WFD and MSFD.

3. Status, Pressures and Trends

3.1 Introduction

This chapter presents the current status of transitional and coastal waters and identifies the human activities and pressures which impact on that status. The chapter primarily addresses the issue of eutrophication, which is the most significant process affecting the condition and ecological functioning of these waters. It explains how eutrophication manifests itself in these ecosystems, the main difference between the factors that control the eutrophication process in marine waters versus freshwaters and provides the basis for developing an understanding of how to go about developing effective nutrient management strategies. Finally, the chapter concludes with a discussion on trends and the lessons learned from both observing improvements in water quality due to the implementation of management measures, but also from observing declines due to increasing human pressures.

3.2 Current Status of transitional and coastal waters

In the latest EPA Water Quality in Ireland Report covering the period 2019 to 2024, 30% of transitional water bodies and 83% of coastal water bodies are in good or better ecological status (EPA, 2025a)(Figure 3-1). Overall, 52% of surface water bodies, which include rivers, lakes, transitional and coastal waters are in good or better ecological status. This represents a decline when compared to the previous assessment when 54% of surface waters were in satisfactory condition.

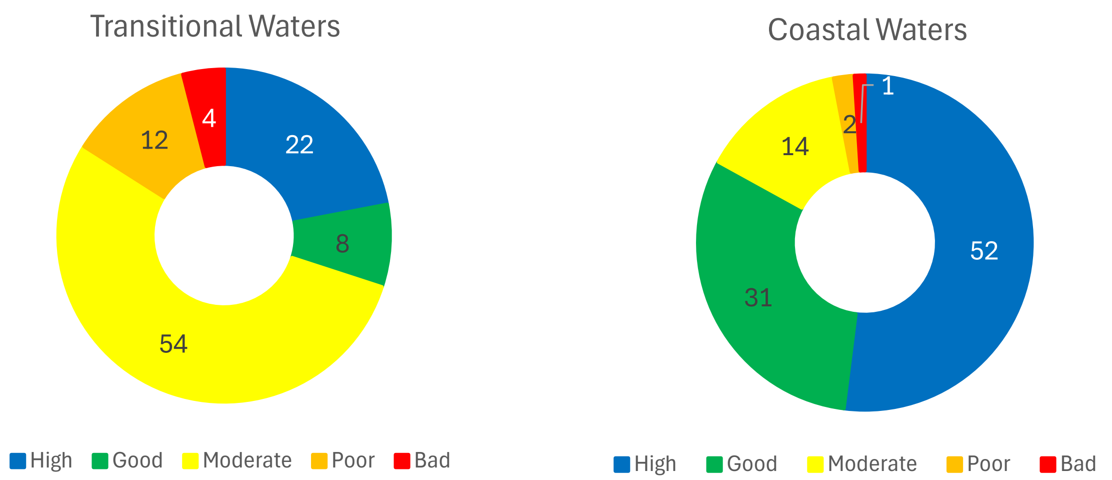

Figure 3-1 Percentage (%) of transitional and coastal waters in each of the WFD classes for the period 2019-2024

Across Europe[2], only 39.6% of surface waters are in good or better ecological status and for transitional waters the proportion in good ecological status at 30.8% is similar to Ireland, whereas the proportion of coastal waters in good or better status at 49.9% is lower than Ireland. Indeed, very few countries have a higher proportion of their coastal waters in good or better ecological status than Ireland. Of the countries which have reported so far only Portugal (by percentage of water bodies, 56.1%) and Italy and Greece (by number of water bodies) have a higher proportion of coastal waters in high ecological status.

In the WFD, 'ecological status' is defined as an expression of the quality of the structure and functioning of aquatic ecosystems associated with surface waters. Underpinning this definition are the normative definitions provided in Annex V of the Directive. These provide a qualitative description of the degree of deviation from reference condition for each of the five classification classes. Key words such as minor, slight, moderate, severe and major are used to explain the degree of deviation associated with each of the corresponding classes, namely high, good, moderate, poor and bad (Figure 3-2). The normative definitions and their description of the key changes in the biological communities they describe through each of the five ecological classes is fundamental to the implementation of the Directive.

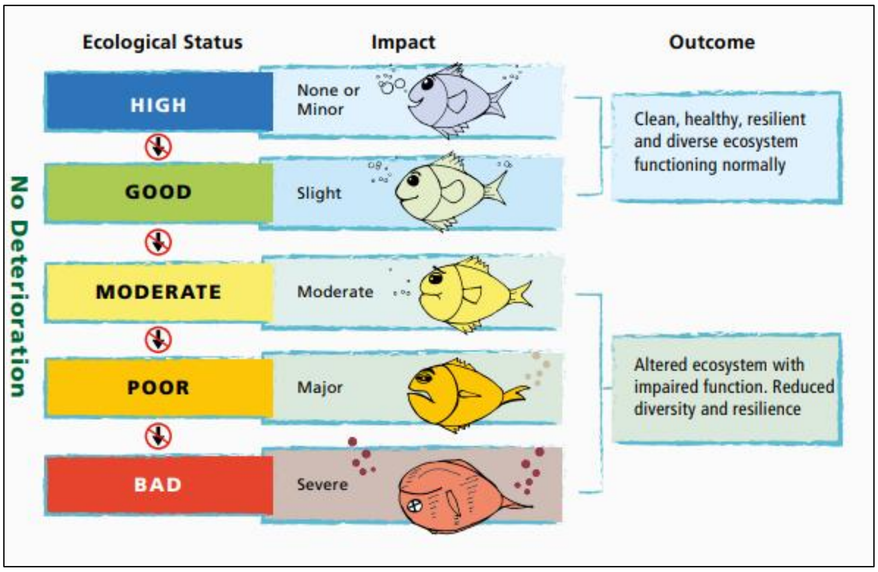

Figure 3-2 Degree of deviation from reference condition and associated impact for each of the WFD classes (Source: EPA).

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[2] Ecological status of surface waters in Europe: Based on data from 21 European countries, including Ireland, who have reported their status results for the 3rd River Basin Management Plan. https://www.eea.europa.eu/en/analysis/indicators/ecological-status-of-surface-waters

These qualitative descriptors and normative definitions have been used to develop quantitative values for the assessment of ecological status that are represented by ecological quality ratios (EQR) which define the degree of deviation from reference condition on a scale from zero to one, with a value of one representing reference condition and a value of zero representing a severe ecological impact. These quantitative values have been further refined in the EU wide intercalibration process which had the purpose of ensuring that the different classes describing ecological status were comparable and consistent across all EU member states.

3.3 Pressures

Coastal waters and in particular transitional waters, given their position at the bottom of a catchment or catchments, can be described as the ultimate receiving water. It follows therefore that these waters are subject to a wide range of human pressures that have the potential to impact on their ecological status.

The main issues are:

- Run-off of nutrients, sediment and pesticides from agricultural lands, farmyards and waste water treatment plants;
- Discharges of inadequately treated sewage from urban waste water treatment plants, domestic treatment systems, storm water overflows and urban run-off;
- Maintenance and capital dredging in ports and harbours and coastal defence works;
- Pressures from fishing and aquaculture activities;
- Introduction and presence of invasive alien species.

Changes that may result from climate change such as warmer sea temperatures and rising sea levels may further exacerbate these issues.

According to the EPA Water Quality in Ireland report (EPA, 2025a) the greatest pressure on surface waters (rivers, lakes, transitional and coastal waters) is agriculture (60% of impacted water bodies are affected by this activity) followed by hydromorphology (27% of impacted water bodies), forestry (12%) and urban waste water discharges (12%).

If we look specifically at transitional and coastal waters the picture is somewhat different. Agriculture remains the dominant pressure with 65% of impacted water bodies affected, followed by urban waste water (39%), urban run-off (22%) and domestic waste water (9%).

Hydromorphology only affects 6% of impacted waters while forestry is not identified as a significant pressure in any of the impacted water bodies[3].

The profile for transitional and coastal waters is not entirely surprising given the location of many estuaries in urban settings and as receiving waters of discharges of urban waste water from coastal population centres. Activities which impact on hydromorphology do occur in transitional and coastal waters but these tend to be localised (i.e. maintenance dredging, port and harbour development, coastal defence works[4]). Activities from agriculture is still the greatest pressure affecting impacted transitional and coastal waters as well as more broadly across the other surface water categories.

3.4 What do we know about how pressures impact on status?

The different pressures discussed in the section above impact the status of transitional and coastal waters in different ways. For example, the aforementioned maintenance dredging can result in sediment plumes which can settle on sensitive benthic habitats or noise from certain activities can impact on marine mammals such as whales and dolphins. However, the most widespread pressure impacting on the status of transitional and coastal waters are those pressures which result in the loss of nutrients to our waters and the development of nutrient enrichment and the phenomenon of eutrophication.

Eutrophication refers to the process by which too many nutrients (nitrogen and phosphorus) in our waterways results in the growth of algal blooms. When these blooms begin to decay and die, bacteria break them down, consuming large amounts of dissolved oxygen which can lead to hypoxic (low oxygen) conditions and the death of fish and other aquatic life.

If we look specifically at the source of these different nutrients, we see for nitrogen the largest source, by far, is agriculture (pasture and arable), followed by urban waste water, whereas for phosphorus the main source is urban waste water, followed by agriculture (Table 3-1). The figure below shows the estimated load of nitrogen and phosphorus from a range of different sources[5] to surface waters (Mockler, 2017). These figures show that

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[3] EPA GeoPortal database. https://gis.epa.ie/GetData/Download

[4] Impacts on hydromorphology from activities such as bottom trawling can be significant but these are not addressed directly by the WFD.

[5] The OSPAR PARCOM Source Apportionment (PSA) programme uses a set of published guidelines (Harmonised Quantification and Reporting Procedures for Nutrients) to estimate the potential loading from various sources, such as agriculture, urban wastewater treatment, industry, unsewered populations, and forestry.

nitrogen sources are primarily coming from diffuse sources, while phosphorus sources are coming from a mixture of point and diffuse sources.

Table 3-1 Nitrogen (N) and Phosphorus (P) emissions in tonnes per year (t yr^{-1}) and percentage (%) contribution from various sources (Mockler et al., 2017)

Sources	Nitrogen	Phosphorus
Area (km2)	70,803	70,803
Total Emissions (t yr−1)	82,190	2766
Wastewater	10%	42%
Other licensed discharges	1%	1%
Diffuse urban	1%	6%
Septic tank systems	2%	2%
Pasture	69%	29%
Arable	10%	2%
Forestry	3%	9%
Peatlands	2%	7%
Deposition on water	2%	2%

3.5 Understanding the eutrophication process

The process of eutrophication is a global phenomenon (see Conley et al., 2000; Conley et al., 2009, Cloern 2001; Boesch 2002; Kemp et al., 2005). The best known impact of eutrophication is the presence of what are known as dead zones, areas of estuarine or coastal waters devoid of, or very low, in dissolved oxygen. The impact of this can be devastating on marine organisms and the functioning of marine ecosystems. For example, in the northern Gulf of Mexico, nutrient enrichment has resulted in fish kills, reduced species richness, impacts on food web structures, proliferation of harmful algal blooms and changes in normal biogeochemical processes. In the Baltic Sea, increased nutrients have led to the massive increase in the presence of blue-green algal blooms which impact on natural systems and economic activity.

In Ireland, our waters are relatively free of these so-called dead zones with only a small number of areas displaying low oxygen levels during the summer months (e.g. parts of Mulroy Bay in Co. Donegal, Lough Furnace in Co. Mayo and Lough Hyne in Co. Cork, see O'Boyle et al. 2009, Plowman et al. 2020). It should be noted however that increasing water temperatures (warmer water holds less dissolved oxygen and increases the metabolic rate of the bacteria that consume oxygen) may increase the vulnerability of some waters to periods of oxygen depletion as appears to be the case in other marine regions (Hepach et al., 2024). As such it will become increasingly important to understand the impact of climate change and potential increase in sea temperature on the vulnerability of certain waters that may be exposed to the effects of eutrophication.

Given the extent of the eutrophication problem globally it is not surprising that this issue has been one of the most researched topics in marine science. One of the seminal papers on the subject was published by James Cloern a senior research scientist in the United States Geological Service. In his paper he presents an evolving concept of the eutrophication process in estuarine and coastal waters from the earlier concept driven by our understanding of the phenomenon in freshwater systems (Phase 1) to our understanding of the process in estuarine and coastal systems (Phase 2). While increased nutrients in freshwater and marine systems can lead to increased algal and plant growth, the process in marine systems can be affected or modulated by a range of factors that are either not present or as prevalent in freshwater systems such as the effects of reduced water transparency, shorter residence times and greater variation in the ratios of nutrients available for algal growth.

These differences mean that estuarine and coastal systems display a range of sensitivities to nutrient enrichment. For instance, in his review, Cloern compared different systems which had different sensitivities to nutrient inputs even though both types of systems were receiving comparable amounts of nutrients. He concluded that understanding the factors that are modulating this response will be critical in developing effective nutrient management strategies.

In Ireland, our understanding of the eutrophication process has greatly increased in recent decades helped in part by the extensive monitoring programmme and assessment schemes developed for the purposes of implementing the Water Framework Directive. The monitoring undertaken as part of the national WFD monitoring programme, which is primarily designed to collect information to assign water status to individual water bodies, has also been used to identify and characterise the extent of eutrophication in Irish transitional and coastal waters.

In general, the occurrence of eutrophication in these waters either manifests itself as the formation of microscopic algal blooms which multiply to a level that can result in water discolouration or the growth of macroscopic algal blooms visible as mats of green/brown/red seaweed. Some examples of where these blooms occur or have occurred in Ireland are listed in Table 3-2. Typically, these different types of blooms rarely co-occur and the reason for this is explained later. Also of note, which is included in Table 3-2 for completeness is the relatively regular occurrence of the ‘red tide’ forming dinoflagellate species *Karenia mikimotoi*, which can cause devastating impacts on marine fauna when it occurs. However, the occurrence of this species is linked more to the advection of already established offshore populations inshore to coastal bays and estuaries and not linked to localised nutrient enrichment (Raine and McMahon, 1998).

Table 3-2 Documented phytoplankton and macroalgal bloom events in Irish coastal and estuarine waters

Bloom Type	Water Body	Description
Phytoplankton bloom	Lough Mahon, Co. Cork	Exceptional bloom of the dinoflagellate *Akashiwo sanguinea* with cell densities up to 16,900 cells $ml^{-1}$and chlorophyll levels as high as 680 mg l^{-1} (O'Boyle and McDermott, 2014)
Phytoplankton bloom	North Channel, Co. Cork	Exceptional bloom of the dinoflagellate *Glenodinium foliaceum* in the North Channel, Co Cork (author, pers. observations)
Phytoplankton Bloom	Lower Slaney estuary and Wexford Harbour	Exceptional bloom of the diatom *Cylindrotheca closterium* in Wexford Harbour with cell densities exceeding 20,000 cells ml^{-1} (author, pers. observations)
Phytplankton Bloom	Southwestern coastal waters.	Exceptional blooms of the dinoflagellate *Karenia mikimotoi* in Roaringwater Bay with cell densities ranging between 2,000 to 8,000 cells ml^{-1} in summer 1978 (Roden et al., 1980) and further exceptional blooms occurred in Bantry Bay in 1987 and 1991 (Raine et al., 1990a, b, 1993)
Macroalgal bloom	Dublin Bay	Excessive growth and stranding of a brown algal bloom in Dublin Bay (*Ectocarpus* species) (Jeffrey et al., 1992)
Macroalgal bloom	Argideen estuary, Courtmacsherry, Co. Cork	Opportunistic bloom (*Ulva* species) covering an area of 129 hectares and having a total algal biomass of 2,164 tonnes (Wan et al., 2017)
Macroalgal bloom	Dundalk Bay, Co. Louth	Excessive accumulation of a brown algal bloom (*Ectocarpus* species) along the intertidal zone of inner Dundalk Bay
Macroalgal bloom	Tolka estuary, Co. Dublin	Opportunistic bloom (*Ulva* species) covering an area of 40 hectares and having a total algal biomass of 540 tonnes (Wan et al., 2017)
Macroalgal bloom	Clonakilty Bay, Co. Cork	Opportunistic bloom (*Ulva* species) covering an area of 76 hectares and having a total algal biomass of 845 tonnes (Wan et al. 2017)
Macroalgal bloom	Dungarvan Bay, Co. Waterford,	Opportunistic bloom (*Ulva* species) covering an area of 76 hectares and having a total algal biomass of 845 tonnes (Wan et al., 2017)

3.6 Factors affecting the occurrence of algal blooms in Irish waters

The factors controlling or modulating the response of microscopic and macroscopic algal blooms to nutrient enrichment in Irish transitional and coastal words is reasonably well understood.

3.6.1 Microscopic Blooms

A conceptual model of how phytoplankton respond to nutrient enrichment in these waters has been developed by O'Boyle et al., (2015). This model has clarified how light availability, residence time and nutrient availability influences the response of phytoplankton to elevated nutrients. The development of the model highlighted that while many of the estuaries are considered to be nutrient enriched, relatively few display symptoms of eutrophication and identified that the occurrence of eutrophication was being limited by inadequate light availability and/or short residence times. This is not surprising as many estuaries display low light levels due to the presence of suspended matter and many have short residence times due to the action of tidal and river flows.

A number of estuaries known to be rich in nutrients such as the Lower and Middle Suir estuaries show little response to nutrient enrichment due to low light levels for photosynthesis. Short residence times can also inhibit the eutrophic response. For example, in the upper reaches of nutrient enriched estuaries such as the upper reaches of the Slaney estuary and Blackwater estuary, phytoplankton growth is limited by low residence time, and phytoplankton are exported from the estuary before they have the opportunity to replicate and grow. Table 3-3 provides some further examples of other estuaries where the eutrophic response is affected by factors such as light availability and residence time. Importantly it also highlights those water bodies where nutrient availability limits phytoplankton growth which is what would be expected to be the scenario in waters unimpacted by anthropogenic nutrient enrichment, where light availability is adequate and loss rates are not excessive.

Table 3-3 Sensitivity of Irish Estuarine and Coastal Water Bodies to Nutrient Enrichment Under Varying Environmental Scenarios (after O'Boyle et al., 2015).

Scenario	Water body	Modulating Factor	Sensitivity
High Nutrients **Low Algal Biomass**	Lower Suir Estuary Middle Suir Estuary Upper Slaney Estuary Upper Blackwater Estuary Fergus Estuary	The eutrophic response in these water bodies is being modulated by either **light availability** or **residence time**	Less sensitive to nutrient enrichment due to presence of modulating factors
High Nutrients **High Algal Biomass**	Lower Bandon Estuary Lower Slaney Estuary Upper Suir Estuary	No strong primary modulating factor.	Highly sensitive to nutrient enrichment

	Upper Bandon Estuary		due to absence of modulating factors
Low Nutrients **Low Algal Biomass**	Kinsale Harbour Dublin Bay Gweebarra Bay Killary Harbour Sligo Bay Outer Dundalk Bay	The eutrophic response in these water bodies is being controlled by low nutrient availability for algal growth. Unlikely to be modulated by light availability or residence time as both would appear sufficient for algal growth	Potentially sensitive to nutrient enrichment if nutrient levels increase

Light limitation of phytoplankton growth is considered to occur when the mixing depth (Zm) exceeds the photic depth by a factor of 5, as respiration by phytoplankton cells is likely to exceed primary production. This factor was used to identify waters where light availability was likely to play an important role in modulating the eutrophic response. For example, in the lower Shannon Estuary and lower Suir Estuary, the mixing depth is more than 5 times the photic depth, which means that even in the presence of sufficient nutrients, these water bodies are unlikely to show a strong response to nutrient enrichment. Similarly, water bodies with short residence times of only a few days are unlikely to support the sustained growth of phytoplankton populations and therefore less sensitive to nutrient enrichment (although this observation may be less relevant when discussing attached macroalgal blooms – see below).

Conversely, areas likely to be more sensitive to nutrient enrichment are those areas with adequate light availability and where residence times extend to weeks rather than a few days.

3.6.2 Macroscopic Blooms

For macroscopic blooms we know less about the factors which control their occurrence apart from the observation that most occur in close proximity to a significant anthropogenic source of nutrient. Many also occur in sheltered shallow bays but in close proximity and connection to open coastal waters such as the blooms which occur in Courtmacsherry Bay and the inner parts of Clonakilty Harbour in County Cork and Dungarvan Harbour in County Waterford. Here, the hydrodymamics (short residence times) would suggest that nutrients should be relatively quickly flushed from the system and diluted with inflowing coastal water. This would suggest that such areas should not experience blooms—yet they do.

The reason for this appears to be two-fold.

First, the hydrodynamic regime in these estuaries, where complete flushing can occur within one or two tidal cycles, favours organisms that attach to or grow on the estuary bed rather than planktonic species like phytoplankton, which are quickly removed from the water column (Painting et al., 2003). Consequently, these conditions promote macroalgal growth over planktonic organisms.

Second, the hydrodynamic link to adjacent coastal waters plays a critical role. Numerical modelling has shown that this connection creates conditions conducive to macroalgal proliferation (Ní Longphuirt et al., 2015a). Coastal waters can act as a phosphorus source, and when marine water, relatively rich in phosphorus, enters these estuaries, it combines with elevated nitrogen from river inflows, creating an environment that supports substantial macroalgal growth (Ní Longphuirt et al., 2015a).

The implications of these findings for the design of management measures are profound. In the Argideen estuary, for example, phosphorus load reduction would have minimal impact on macroalgal growth due to the increased flux of phosphorus from marine sources.

The material presented above highlights the importance of understanding the factors that modulate the response of biological systems to nutrient enrichment. Without this understanding it becomes difficult to develop effective measures to address the issue of eutrophication and impacts on ecological status.

3.7 Nutrient Management

Another issue which makes managing the problem of eutrophication in transitional and coastal waters more complex, is the difference in the sensitivity of these waters to different types of nutrient when compared to freshwater systems. Typically, due to a number of biogeochemical differences between nutrient cycling in freshwater and coastal systems, freshwater systems are typically limited by the availability of phosphorus (P), whereas marine systems are limited by the availability of nitrogen (N). This means, as one travels from freshwater systems through estuarine waters and out to the open sea, nutrient limitation shifts from potential phosphorus to nitrogen limitation along the freshwater-marine continuum.

Some of the reasons why this is the case is the greater influence of nitrogen fixation (i.e. the addition of N) in freshwaters when compared to their coastal counterparts and the higher rates of denitrification (i.e. the removal of N) in coastal environments in comparison to freshwater ones. Another reason being the greater availability of phosphorus (i.e. the addition of P) in estuarine and coastal waters due to the desorption of phosphorus from suspended particles in saline waters.

This is the reason (there are others as well[6]) why phosphorus levels in unimpacted estuarine and nearshore coastal waters can be higher than the biologically available phosphorus concentration in freshwaters flowing into these systems. As mentioned above the inflow of seawater relatively rich in phosphorus appears to play an important role in the occurrence of macroalgae blooms in estuaries which are directly influenced by inputs of high salinity water from adjacent coastal areas (Ní Longphuirt et al., 2015b).

The difference in the relative sensitivity of fresh and marine waters has meant that past efforts to improve water quality in freshwater systems has focused primarily on the removal of phosphorus and less on the removal of nitrogen. The consequence of this has been a disproportionate reduction in the amount of phosphorus entering the sea when compared to nitrogen (see the section below for further details). This has a number of effects which can result in significant impacts on the functioning of estuarine and coastal systems.

One of the most obvious effects from the disparity is the creation of an imbalance between the ratio of nitrogen and phosphorus entering the sea. Typically, the ratio between these two nutrients (N:P) should vary from around approximately 75:1 in the upper reaches of estuarine waters to approximately 16:1 (the Redfield Ratio[7]) in open coastal and offshore marine waters. In some estuarine waters along the south coast of Ireland this ratio is as high as 500:1 due mostly to the disproportionate reduction of P over N (O'Boyle et al., 2015).

This in turn can have a number of knock-on effects on nutrient cycling in downstream estuarine waters. Not surprisingly one of the main impacts can be an increase in P-limitation in waters that would typically have been N-limited under more normal conditions. This appears to be the case in a number of coastal water bodies along the south coast of Ireland. For example, phytoplankton growth in summer in Cork Harbour, Youghal Bay, Dungarvan Bay, Waterford Harbour and Wexford Harbour is potentially limited by the availability of phosphorus rather than nitrogen, although in general, nitrogen is likely to be the main nutrient limiting phytoplankton growth in other areas around the Irish coast (O'Boyle et al. 2015).

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[6] A full explanation of the different biogeochemical processes and their consequences for ambient nutrient levels and ratios is beyond the scope of this report but an excellent description is given by Hecky and Kilham, 1988.

[7] A ratio discovered by Albert Redfield an American oceanographer who discovered the atomic ratio of nitrogen to phosphorus in marine phytoplankton collected from around the world was remarkably constant at a ratio of 16 atoms of nitrogen to 1 atom of phosphorus.

The disproportionate reduction in nitrogen and phosphorus and steady increase in the N:P ratio has also been seen in other sea areas such as the southern North Sea, Mediterranean Sea and Atlantic Ocean (Grizzetti et al. 2012). There is also evidence that as P limitation increases it limits phytoplankton growth and the biological uptake of nitrogen. This in turn can result in the greater export of nitrogen to coastal waters.

This has already been reported in other estuaries, such as the Neuse River Estuary in North Carolina, where a reduction in P-limited phytoplankton production in the upper estuary (as a result of P removal in waste water treatment plants , but not N) resulted in the downstream movement of nitrogen and an enhancement of downstream phytoplankton production (Paerl et al., 2004).

There is evidence that a similar process may be occurring in the Blackwater Estuary in Counties Cork and Waterford. A study by Ní Longphuirt et al. (2015b) showed that while reductions in P and N loadings to the estuary resulted in reduced phosphorus concentrations and reduced phytoplankton biomass, there was no corresponding change in nitrogen concentration in the estuary, suggesting stronger P-limited phytoplankton production was resulting in less biological uptake of nitrogen.

These are just some examples of how the interplay of varying nutrient limitation along the freshwater-marine continuum can strongly influence the nature of the phytoplankton driven eutrophic response. They also highlight that management measures put in place to address the problem of eutrophication can in some cases result in unintended consequences. One such consequence being the weakening of the estuarine N filter, as eutrophication symptoms lessen, and the increased export and downstream movement of nitrogen to more sensitive N-limited coastal waters.

The variation in nutrient limitation along the freshwater-marine continuum also needs to be considered when devising nutrient management measures to address the occurrence of macroalgal blooms. In the Argideen Estuary in west Cork, which is heavily impacted by the presence of green opportunistic macroalgae (up to 2,000 tonnes of macroalgae can occur in summer), the interaction between nutrients entering the estuary from freshwater sources (rich in nitrogen) and nutrients entering from the adjacent coastal area (relatively rich in phosphorus) plays a vital role in sustaining these blooms. Modelling showed that in the Argideen Estuary, phosphorus load reduction would have potentially minimal impact on macroalgal growth due to the influx of phosphorus from marine sources (Ní Longphuirt et al., 2015a). Conversely, the model did indicate that reducing nitrogen loads would be more effective, but levels would need to be reduced by more than 60% to have an effect.

In the same study, the response of the Blackwater Estuary was also modelled. This estuary is more river-dominated than the Argideen Estuary and therefore less influenced by the influx of phosphorus from adjacent coastal waters. Under this scenario, modelled reductions in phosphorus resulted in a considerable decrease in macroalgal biomass. However, the author did note that any further reduction in phosphorus loading may increase the N:P ratio and result in the greater export of nitrogen to coastal waters.

This example again supports the view that a more holistic and integrated approach is required to address and manage the issue of eutrophication along the freshwater-marine continuum. The strategy for nutrient management needs to focus on both nutrients and have a well understood concept of some of the factors described above so as to be able to develop a portfolio of separate but complementary measures that will effectively address the issue of eutrophication in these waters.

3.8 Trends

While the focus in recent years has been on changes in ecological status as assessed against the Water Framework Directive, and evidence that trends in ecological quality are going in the wrong direction, it is still important to recognise that overall there have been significant improvements in estuarine water quality since the early 2000s.

Much of this improvement has been due to improved urban waste water treatment with nearly all plants (98.4%) now receiving treatment: 59.7% receive at least secondary treatment and 38.7% receive tertiary treatment, although concerns still remain about compliance with discharge standards, stormwater overflows and the continued discharge of raw sewage into surface waters (EPA, 2025b). Nevertheless, the direction of travel has been positive and the level of organic pollution resulting from urban waste water treatment discharges has greatly diminished (O'Boyle et al., 2009). These improvements, in tandem with improvements in agricultural practices (e.g. improved manure storage, enhanced nutrient management systems and more efficient use of fertiliser), has resulted in a significant reduction in the input of organic waste to our waterways.

This trend has also been apparent in the reduction of nutrient inputs to the marine environment. Long-term monitoring since 1990[8] of the main rivers flowing into the marine environment indicate a significant reduction in the amount of nutrients (both phosphorus

[8] Monitoring of nutrient inputs from 19 major Irish rivers to estuarine and coastal waters has been ongoing since 1990 as part of the Oslo Paris Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR). Measuring these inputs provides a useful indicator of trends in the transfer of nutrients from land-based sources.

and nitrogen) entering our waterways which peaked in the mid-1990s but showed significant reductions up to 2013. This trend was also evident in the biological quality of rivers as measured using the EPA's Q-value macroinvertebrate index which showed an improving trend up to 2012 (EPA, 2019). An EPA funded study of 18 catchments (Ní Longphuirt and Stengel, 2016) showed that riverine inputs of phosphorus and nitrogen reduced between 2000 and 2013 and this was matched by a reduction in estuarine molybdate reactive phosphorus (MRP) and chlorophyll concentrations but not by concentrations of dissolved inorganic nitrogen which remained unchanged, again highlighting the likely reduction in the estuarine N filter described above (Figure 3-3).

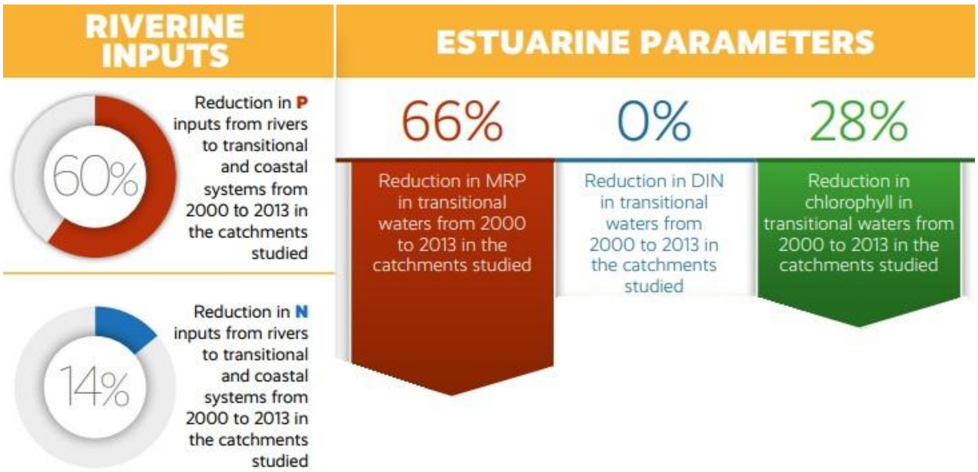

Figure 3-3 Change in riverine inputs and estuarine concentrations of MRP, DIN and chlorophyll across 18 catchments between 2000 – 2013 (Modified from Ní Longphuirt and Stengel, 2016)

Since 2014 however, the trend has reversed, and nutrient inputs to the marine environment have increased. Average total nitrogen in 2019-2021 has increased by 11,131 tonnes (20%) since 2012-2014. Average total phosphorus rose by 394 tonnes (37%) over the same period undoing the gains made over previous years (EPA, 2022). These trends, however, may be showing early signs of stabilising with inputs of nitrogen and phosphorus[9] to the marine environment over the most recent assessment period (2022-2024) showing declines (EPA, 2025a).

The trends noted above seem to be consistent with the trends we are seeing in the ecological status of transitional and coastal waters. This is particularly notable in the status

[9] Based on inputs of inorganic P and N rather than total P and N as shown in previous reports.

of transitional waters which have shown a marked decline in the proportion of waters in good or better ecological status and an increase in the number in poor or bad status since 2007-2009 (Figure 3-4). The picture for coastal waters is mostly unchanged.

To better understand some of these trends, and how changes in nutrient inputs and human activity can impact on estuarine water quality, it would be helpful to focus on one particular area which has been studied extensively in recent years.

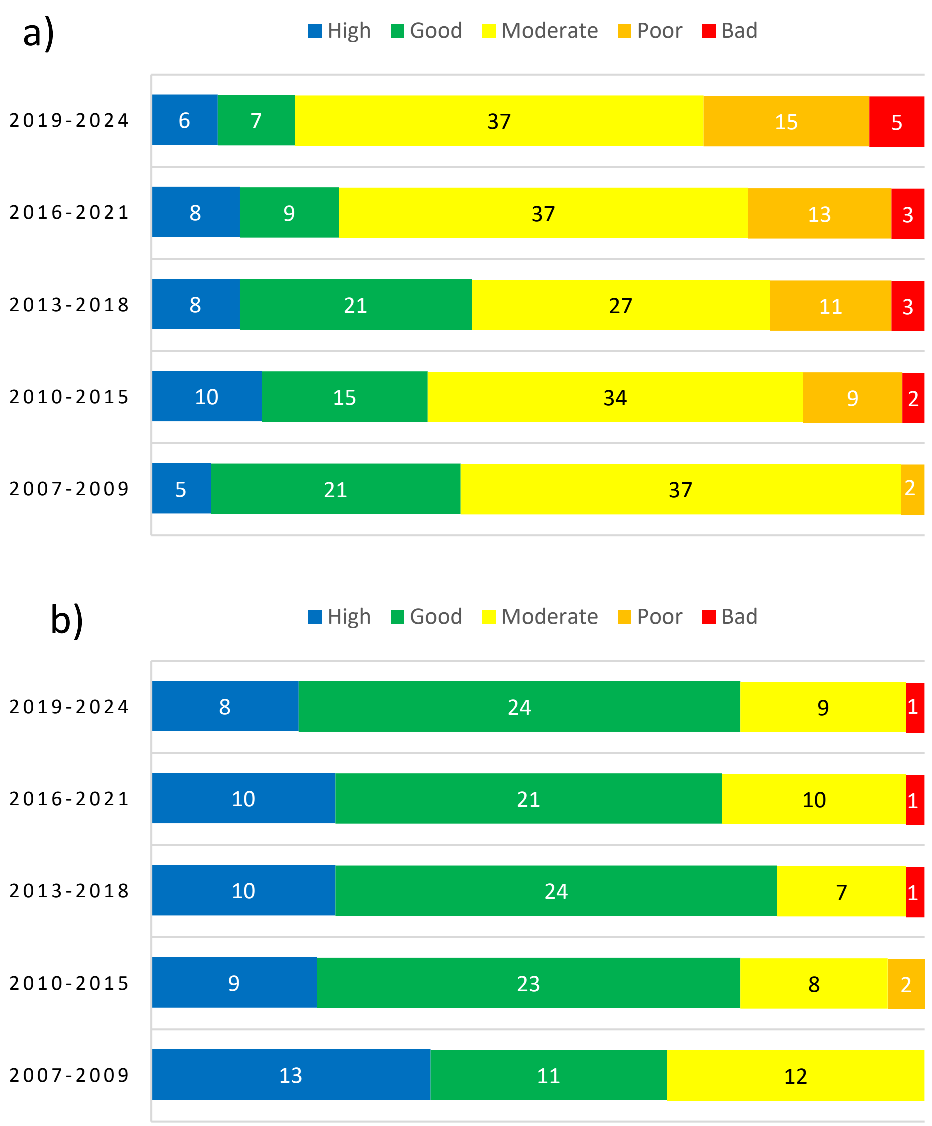

Figure 3-4 Change in a) transitional waters and b) coastal waters since the first assessment period in 2007-2009

3.9 The story of the Blackwater Estuary

One such area is the Blackwater Estuary which drains a large agricultural catchment in southern Ireland. The estuary has shown periods of improvements as a result of implemented measures and resulting reduction in nutrient inputs, but also periods of decline as pressures from human activities increased.

In the late 1990s and early 2000s, the estuary was considered to be nutrient enriched and eutrophic but a marked improvement in trophic status was seen from 2007 until 2012 with the assessment for the period 2010-2012 indicating that the estuary was no longer suffering from the symptoms of eutrophication (Ní Longphuirt et al., 2015b).

An assessment of nutrient sources in the catchment corresponding to this period indicated a decrease in nitrogen (N) and phosphorus (P) loads of 17% and 20% respectively, between 2000 and 2011, which also corresponded to reductions in measured loads of river inputs to the estuary. The main changes in nutrient sources included the reduction in inorganic fertiliser application rates which resulted in a 34% and 53% reduction in N and P loadings respectively, along with a reduction in sheep numbers which decreased by 70%, from 270,000 to 80,000 animals.

In the estuary, these reductions resulted in a marked decrease in the concentration of phosphorus and phytoplankton biomass and an improvement in the amount of dissolved oxygen available for aquatic life, and ultimately an improvement in the trophic status of the estuary.

Improvements in water quality in other estuarine systems in other jurisdictions in response to nutrient reduction measures have also been observed. For example, in Denmark, reductions in nutrient inputs from land of approximately 50% for N and 56% for P have resulted in corresponding reductions in estuarine nutrient concentrations, water column phytoplankton biomass, a recovery of bottom growing macrophyte communities and expansion in the distribution of eelgrass meadows in response to improving water clarity (Riemann et al., 2016). Improvements have been seen in other areas following the implementation of nutrient reduction measures such as Tampa Bay in the United States (Johansson & Lewis, 1992) and the rapid recovery of dissolved oxygen levels in the Forth Estuary in Scotland (Griffiths, 1987) and in the Thames Estuary in England (Attrill, 1998) following improved wastewater treatment.

The Blackwater Estuary and the other estuaries are good examples of where improvements have occurred in response to the implementation of appropriate measures. Unfortunately, in the case of the Blackwater Estuary the improvements seen up to 2012 have now been reversed and the estuary is currently in moderate ecological status (EPA, 2025a). This outcome is consistent with predictions about the response of the estuary to increasing inputs of nutrients as a result of increased agricultural production (O'Boyle et al., 2016). Although the aforementioned study predicted the decline in ecological status as a result of increasing pressures, it is also highly informative, in the sense that our current level of understanding of these systems allow us to predict how changes in human activities will impact upon them. This understanding, and the tools developed to support it (i.e. numerical modelling tools and relatively simple ecosystem response models[10]) can be used to predict and to target mitigation measures more or less on a case-by-case basis. In this way measures can be targeted, evidenced based and ultimately highly effective.

3.10 Conclusion

The ecological status of Ireland's transitional and coastal waters presents a complex and evolving picture. While Ireland continues to perform relatively well in a European context, particularly in terms of coastal water quality, the recent decline in the proportion of transitional waters achieving good or better ecological status is a cause for concern. This trend reflects a broader pattern of increasing nutrient inputs, particularly nitrogen and phosphorus, reversing the gains made in previous decades through improved wastewater treatment and improved agricultural practices.

The chapter underscores the multifaceted nature of pressures impacting these waters, with agriculture emerging as the dominant source of nutrient enrichment, followed by urban wastewater and diffuse urban runoff. The phenomenon of eutrophication remains the most pervasive threat to ecological health. However, the response of transitional and coastal systems to nutrient inputs is not uniform. Factors such as light availability, water residence time, and hydrodynamic connectivity to coastal waters significantly modulate the manifestation of eutrophication symptoms along the freshwater-marine continuum.

The case of the Blackwater Estuary exemplifies both the potential for recovery through targeted nutrient reduction and the fragility of these gains in the face of renewed pressures. It also highlights the importance of understanding the nuanced interplay between nitrogen and phosphorus dynamics along the freshwater–marine continuum. This complexity underpins the need for the development of a more integrated and adaptive dual-nutrient management strategy from the catchment to the coast. In the absence of such a strategy

[10] The DCPM (Dynamic Combined Phytoplankton Model) is one example of a simple ecosystem model which has been used successfully in Irish estuaries to predict the response of phytoplankton and macroalgae to changes in nutrient dynamics (see Aldridge et al., 2008 for a description of the model).

there's a danger that the management measures put in place will be ineffective, or even worse, may simply transfer the problem elsewhere.

Ultimately, the chapter illustrates that while progress has been made, sustaining and improving the ecological status of transitional and coastal waters requires a deeper understanding of system-specific ecological responses to pressures, and a commitment to coordinated, evidence and science based integrated catchment to coast management strategies.

4. WFD and MSFD – Interactions and Policy Alignment

4.1 Introduction

The purpose of this chapter is to outline the main features of the WFD and MSFD and to examine how these features interact and align in supporting improved water quality in transitional and coastal waters. This chapter will compare the objectives and implementation pathways of both directives, their geographic scope, the criteria, standards and indicators used to measure progress towards achieving good water status for the WFD and good environmental status for the MSFD. It will also compare the governance arrangements of each directive, the nature of the monitoring programmes established or considered for each as well as the programmes of measures put in place to achieve their objectives.

This information will be used to inform an analysis of the strengths and weaknesses of both directives and conclude with a set of recommendations aimed at delivering better outcomes for the ecological and environmental status of transitional and coastal waters.

4.2 Objectives and Implementation

The objectives of the WFD and MSFD are broadly aligned in that both directives are seeking to protect the aquatic environment, but they do differ in scope and approach.

The WFD aims to achieve good water status for all surface waters (rivers, lakes, transitional waters and coastal waters) and groundwaters by 2015 with extensions to 2021 and 2027. For surface waters, water status is comprised of good ecological status and good chemical status and is assessed against a defined set of biological elements (i.e. macroinvertebrates, fish, macrophytes, phytoplankton) for ecological status and a list of priority substances and priority hazardous substances for chemical status.

The MSFD targets good environmental status of marine waters by 2020. Good environmental status is defined against a much broader set of descriptors such as biodiversity, eutrophication, contaminants, commercial fisheries, litter, noise and food-web dynamics. There are 11 descriptors in total and these are shown in Table 4-1. As can be seen from the list of descriptors the MSFD addresses a much broader set of pressures compared to the WFD.

Table 4-1 The MSFD Descriptors

No.	Descriptor	Description
1	Biodiversity	Maintaining the diversity of marine life
2	Non-indigenous species	Ensuring invasive species do not harm the ecosystem
3	Commercial Fish and Shellfish	Ensuring populations are healthy and within safe biological limits
4	Food Webs	Ensuring the abundance and diversity of the food web to support the long-term health of species and their reproductive capacity
5	Eutrophication	Minimizing human-induced eutrophication and its negative effects, like loss of biodiversity and harmful algae blooms
6	Seabed Integrity	Ensuring the integrity of the seabed is protected
7	Hydrographical Conditions	Permanent alteration of hydrographical conditions does not adversely affect marine life
8	Contaminants	Concentrations of contaminants are at levels not giving rise to pollution effects
9	Contaminants in Seafood	Contaminants in fish and other seafood for human consumption do not exceed levels established by Union legislation or other relevant standards
10	Marine Litter	Properties and quantities of marine litter do not cause harm to the coastal and marine environment
11	Energy, including underwater noise	Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment

Both directives promote the enhancement of aquatic systems, sustainable use of natural resources and public participation in implementation.

In terms of implementation, the WFD is implemented through the development and implementation of river basin management plans which set out the objectives to be achieved for each water body and a programme of measures required to achieve these objectives. A new river basin management plan is published every 6 years and Ireland's 3rd river basin management plan known as Ireland's Water Action Plan 2024 is the latest plan to be published.

The MSFD is implemented through marine strategies established by member states, with each member state performing an assessment of pressures and impacts, describing what good environmental status looks like, defining monitoring programmes as well as a programme of measures to improve the health of its marine waters. For the purpose of implementation Ireland has divided its marine strategy into three parts.

Marine Strategy Part 1: an initial assessment of the marine environment (Art. 8 of the MSFD), a description of GES (Art. 9), environmental targets and associated indicators (Art. 10). Ireland's latest Marine Strategy Part 1 was published in 2024[11].

Marine Strategy Part 2: the MSFD monitoring programmes (Art. 11) was updated in 2021 and includes information on the 20 monitoring programmes and 36 surveys included to provide an assessment of the current status of Ireland's marine environment.

Marine Strategy Part 3: Programme of Measures (Art. 13). A revised version of the programme of measures to bring Ireland's marine ecosystems to Good Environmental Status was published in 2022.

4.3 Geographic Scope and Assessment Scales

The geographic scope of both directives varies considerably but does overlap in places.

The WFD covers inland waters, transitional waters (estuaries) and coastal waters up to one nautical mile from the baseline from which the breath of territorial waters is measured. The transitional and coastal waterbodies identified under the directive cover an area of just over 14,200 km^2.

The MSFD covers all marine waters from the baseline seaward to the extent of Ireland's Exclusive Economic Zone (EEZ) and an offshore area to the southwest. This equates to an area of over 500,000 Km^2. The MSFD also includes coastal waters defined by the WFD but only if the particular aspect being addressed is not already being addressed by the WFD. Several MSFD descriptors, such as eutrophication, contaminants and hydrographical conditions will mostly be addressed through the WFD. The MSFD does not include transitional waters as defined under the WFD.

In terms of assessment scales both directives operate at very different scales.

[11] Ireland's Draft Marine Strategy Part 1 Article 8, 9 and 10 report 2024
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The basic assessment scale or assessment unit of the WFD is the water body. In Ireland, a water body can vary in size from a few km^2 for some transitional lagoons to large stretches of coastal water bodies off the northwest or southwest coasts, which may extend to 100s of km^2. This is still small when compared to the area of marine waters covered by the MSFD which extends to over 500,000 Km^2.

In terms of the numbers of water bodies, for WFD implementation, Ireland has identified 195 individual transitional water bodies and 111 coastal water bodies. Indeed, Ireland has the highest number of transitional waters in Europe, representing 19.1% of the total number of transitional water bodies in Europe while only accounting for 5% of the total area. For coastal waters, across Europe, Ireland represents 2% by number and just over 3% by surface area.

For the MSFD, the spatial scale of assessment, not surprisingly, is much larger than the WFD and more flexible in that the different assessment scales, referred to as marine reporting units (MRUs) can be designed to suit the descriptor being assessed. For example, the assessment of Descriptor 5 eutrophication, is undertaken in six ecologically relevant offshore areas and coastal water bodies and Descriptor 6 seafloor integrity, uses four MRU's, based on an OSPAR subdivision of the regional seas. Further detail on how each assessment scale was defined and used is provided in Ireland's latest Marine Strategy Part 1 (DHLGH, 2024). In total, 25 MRUs have been identified for Ireland's 2024 MSFD reporting cycle.

Overall, the differing assessment scales used by the WFD and MSFD can generally be aligned in a way that supports coherent evaluations. However, when it comes to assessing individual development projects, determining the most appropriate scale for each case remains a challenge. This is an area where further guidance and practical approaches will likely need to be developed to ensure consistency and effectiveness in decision-making.

4.4 Criteria, indicators, standards and methodologies

The Water Framework Directive establishes several environmental standards and criteria either referred to as ecological quality ratios (EQRs) or environmental quality standards (EQSs) that are published in national legislation[12] or European Directives[13]. These standards and criteria have mostly been developed to align with the normative definitions given in the WFD which describe the impact of pollution on aquatic organisms and communities.

[12] European Communities Environmental Objectives (Surface Waters) Regulations 2009

[13] 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

The WFD requires the use of CEN (European Committee for Standardisation) standard methods in environmental monitoring and analysis, and these are widely used across member states. The prescriptive nature of the directive in terms of the elements to be monitored and the formal requirement to compare results across member states (i.e. intercalibration) has ensured that the implementation of the directive has been consistent and reasonably harmonised across member states.

Under the MSFD, Commission Decision (2017/848) sets out the criteria and methodological standards for good environmental status as well as the standardised methods of monitoring and assessment. Criteria are provided for each of the 11 descriptors and threshold values are either given in the Decision or left to member states to develop in cooperation with other member states and the regional sea conventions. For descriptors which overlap with the WFD in coastal waters, (i.e. eutrophication, hydrographical conditions, contaminants) the threshold values, assessment and assessment scales must be consistent with those set out in the WFD.

Ireland has developed a set of indicators (Article 10) which can be used to measure progress towards GES and these can be found in Annex III of Ireland's Marine Strategy Part 1 (DHLGH, 2024[14]). Where relevant, Ireland has used indicators developed under the WFD to support the assessment of coastal waters within the MSFD. For instance, the nutrient standard for dissolved inorganic nitrogen (DIN), as outlined in S.I. No. 272 of 2009 (as amended), is used alongside data on chlorophyll, dissolved oxygen, and contaminants gathered through the national WFD monitoring programme. This demonstrates a high degree of integration, with WFD-derived monitoring data effectively contributing to MSFD indicators and the evaluation of good environmental status (GES).

Member states are also required to develop environmental targets under the MSFD (Article 10). These targets can either be related to improvements in state, reduction of pressures, development of guidance to facilitate the achievement of GES and the development of measures. Ireland's Marine Strategy Part 1 includes a total of 49 binding environmental targets, the achievement of which will ensure progress towards the achievement or maintenance of GES. Of the 49 targets listed, several would be of direct relevance to the WFD, particularly those listed under the descriptors for eutrophication, contaminants, hydrographical condition, seafloor integrity and non-indigenous species. One of the targets, under Descriptor 5 Eutrophication, makes direct reference to Ireland's latest river basin

[14] https://assets.gov.ie/static/documents/Irelands_Marine_Strategy_Part_1_2025_Annex_III_Indicators.pdf

management plan and commits to ensuring that actions under Ireland's Water Action Plan 2024 are fully implemented.

Overall, the level of alignment and integration between the two directives is reasonably high, particularly in coastal waters, where their geographic scopes overlap. Alignment and integration are evident in the use of standards developed for the WFD in MSFD indicators, while several of the MSFD environmental targets make direct reference to the actions to be undertaken for the WFD.

The level of integration between both directives could be further strengthened by the development of regulatory standards for the remaining WFD supporting elements that remain outstanding. Notably, the hydromorphological elements outlined in Annex V of the WFD for transitional and coastal waters are not yet supported by corresponding standards within Irish legislation. Addressing these regulatory gaps would significantly enhance the alignment of hydromorphological assessments under the WFD with hydrographical evaluations under the MSFD.

4.5 Monitoring programmes

Both directives require member states to establish national monitoring programmes.

For the WFD, a programme must be established to allow the assessment of both ecological and chemical status of water bodies and to support the development and implementation of national river basin management plans (RBMPs).

Ireland's national WFD monitoring programme is probably one of the single largest environmental programmes in the State and sets out, in great detail, the level of monitoring required to meet the objectives of the directive. The programme covers all the WFD water categories (rivers, lakes, transitional waters, coastal waters and groundwaters) and nearly all the WFD biological (e.g. phytoplankton, macroinvertebrates, fish, macrophytes), physico-chemical (e.g. nutrients, dissolved oxygen), chemical (specific pollutants, priority substances) and hydromorphological elements (morphology and hydrology).

The latest national WFD monitoring programme covers the period 2022-2027[15]. The programme makes no direct reference to the MSFD as its design was focused on meeting the specific requirements of the WFD. It does consider other areas outside of the WFD such as climate change and how the information collected can be used to identify those

[15] https://www.epa.ie/publications/monitoring--assessment/freshwater--marine/EPA_WFD_MonitoringProgramme_2022_2027.pdf

waterbodies which may be vulnerable to climate change or how the programme may need to adapt to different climate change scenarios in the future.

While the inclusion of climate change considerations in the WFD programme shows a willingness to evolve, the absence of MSFD integration implies that opportunities for greater collaboration and coherence are not being fully realised.

Ireland's overall national MSFD monitoring programme forms Part 2[16] of Ireland's marine strategy and is comprised of 20 monitoring programmes and 36 surveys or campaigns undertaken by multiple organisations and for multiple purposes (e.g. Common Fisheries Policy, Natura Directives, WFD, OSPAR and others). The programme was last updated in December 2021. The purpose of the programme is to assess if the marine waters around Ireland are achieving or maintaining good environmental status, to monitor change and to assess the effectiveness of measures put in place to improve the health of Ireland's marine waters. The programme addresses the monitoring requirements for each of the 11 descriptors of the MSFD.

The programme makes reference to the monitoring requirements of other European directives such as the Birds Directive, Habitats Directive and WFD but also states that it considers other pressures not covered by these directives (e.g. marine litter and underwater noise) and also considers some of these pressure at scales beyond what would be covered by the existing European legislation. The programme also relies heavily on the monitoring, assessments and procedures already in place under the OSPAR regional sea convention. OSPAR programmes of direct relevance to both directives include the annual monitoring of nutrient loads to coastal waters (Riverine Inputs and Direct Discharges (RID)), the annual assessment of atmospheric deposition of nitrogen to the marine environment and the monitoring of contaminants (mostly in shellfish and sediments) as part of OSPAR's Coordinated Environmental Monitoring Programme (CEMP).

The programme includes the monitoring of biological elements (i.e. macroalgae, benthic invertebrates, seagrass and phytoplankton) and priority substances undertaken in coastal waters as part of the WFD national monitoring programme. Monitoring of priority substances under the WFD and other contaminants and matrices under OSPAR CEMP is undertaken and coordinated by the Marine Institute. Information on hydromorphological features collected in the national WFD programme is also referenced in the MSFD programme.

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[16] https://assets.gov.ie/static/documents/marine-strategy-framework-directive-200856ec-article-17-update-to-irelands-marine-stra.pdf

The MSFD programme appears to represent a coherent programme that addresses the extensive information needs of the MSFD by bringing together existing programmes and identifying where gaps need to be filled to meet the information requirements for each of the MSFD descriptors and relevant indicators and targets. The elements of the national WFD monitoring programme are also fully integrated. There also appears to be sufficient sharing of the collected data across the various bodies involved and much of the data collected is reported to centralised data repositories in Europe such as the European Environment Information and Observation Network (EIONET), European Marine Observation and Data Network (EMODNet), OSPAR and ICES DATRAS (the database of trawl surveys).

4.6 Programme of Measures

The WFD specifies that member states are required to develop a programme of measures (PoMs) as part of their River Basin Management Plans (RBMPS) (Article 11) which must aim at achieving good ecological and chemical status and preventing the deterioration of water status. Measures are comprised of both basic measures (compliance with exiting EU environmental legislation) and supplementary measures (national measures, codes of good practice, promoting awareness) which must be implemented within 3 years of the publications of the RBMP (Article 13).

Ireland's latest programme of measures was published as part of Ireland's Water Action Plan 2024[17]. The Plan lists 265 measures covering areas such as agriculture, forestry, urban wastewater, hydromorphology, invasive species, hazardous substances and marine protected areas. While the document contains many measures relevant to marine and coastal environments, none of them explicitly mention the **MSFD** by name, nor does it reference the environmental targets established by the MSFD.

However, as can be seen from

Table 4-2, several of the measures listed in Ireland's Water Action Plan 2024 have direct relevance to the implementation of the MSFD.

Table 4-2 Measures in Ireland's Water Action Plan aligned with the Marine Strategy Framework Directive

MSFD Descriptor	Aligned Measures
D5 – Eutrophication	Nutrient reduction via Nitrates Action Programme, CAP Strategic Plan, WWTP upgrades

[17] https://assets.gov.ie/static/documents/water-action-plan-appendix-2-2024.pdf

D8 – Contaminants	EQS amendments, River Basin Specific Pollutant reviews, hazardous chemical monitoring, aquaculture licensing
D1 – Biodiversity	Invasive species control, biodiversity officer recruitment, peatland restoration, Marine Protected Areas (MPAs), estuarine/coastal restoration
D7 – Hydrographical Conditions	Urban drainage plans, hydromorphology restoration, barrier mitigation
D10 – Marine Litter	Role of citizen science
D2 – Non-Indigenous Species	Priority Pathway Action Plans (PPAPs), IAS legislation, mapping and treatment

Under Article 13 of the MSFD, member states must develop and implement a programme of measures to achieve or maintain good environmental status in their marine waters. The directive states that these measures must be cost effective, address pressures identified in the initial assessment and include measures from other EU legislation (e.g. Common Fisheries Policy, WFD) to ensure integration. Member states are also required to report links to other policy areas and to promote regional cooperation through the Regional Sea Conventions and through the EU's Common Implementation Strategy (see below).

Ireland's latest programme of measures for the MSFD was published in 2024 as Part III of Ireland's Marine Strategy[18]. There are over 150 measures identified in the programme which are classified into four types of measures: legal (61), technical (58), policy (29) and economic (4). Actions listed target biodiversity loss, non-indigenous species, pollution, underwater noise, marine litter and the impacts of increased human activity.

The programme makes direct reference to implementing the measures in Ireland's national River Basin Management Plan which include measures aimed at achieving good ecological status in coastal and transitional waters. It also makes reference to Ireland's Nitrates Action Programme, the Urban Waste Water Treatment Directive, the continued identification of Nutrient Sensitive Areas and continued application of the PARCOM Recommendation 88/2 on nutrient reductions to eutrophication problem areas, all of which have direct relevance to achieving the objectives of the WFD. The Programme also identifies measures to be taken in updating and revising the list of specific pollutants, priority substances and hazardous priority substances relevant to the WFD and MSFD, as well as directly referencing the continued implementations of national regulations implementing the WFD environmental objectives for surface waters (SI No 77 of 2019).

[18] https://assets.gov.ie/static/documents/e9828f93-marine-strategy-framework-directive-200856ec-article-17-update-to-irelands-ma.pdf

It is striking that Ireland's Water Action Plan 2024, which outlines 265 measures across a wide range of environmental pressures, including those directly affecting marine and coastal ecosystems, makes no explicit reference to the MSFD. This omission is particularly noteworthy given the clear thematic and geographic overlaps between the WFD and MSFD, especially in areas such as eutrophication, contaminants, biodiversity, and hydrographical conditions.

The absence of any mention of the MSFD or its environmental targets suggests a disconnect in strategic alignment between the two directives. While many of the measures listed in the Water Action Plan 2024 are evidently relevant to MSFD implementation, as demonstrated in the alignment table, the lack of formal recognition points to a missed opportunity for policy coherence. It reflects a broader issue in environmental governance where directives operating within the same ecological space are not sufficiently integrated at the planning level.

This raises important questions about the effectiveness of cross-directive coordination and the potential inefficiencies that may arise from parallel but unlinked efforts. Strengthening the visibility and integration of the MSFD within WFD planning documents could enhance transparency, improve resource use, and support a more unified approach to achieving good environmental status (MSFD) and good ecological status (WFD) across Ireland's marine and coastal waters.

It should be pointed out, however, that Ireland is not alone is displaying a lack of coordination in this area. A recent report by the European Commission (EC, 2025) on the implementation of the WFD found that only a few member states showed evidence of clear coordination in developing the WFD and MSFD programmes of measures in terms of process, content and consistency in response to the same pressures.

4.7 Governance

The governance frameworks for the Water Framework Directive and the Marine Strategy Framework Directive in Ireland share several structural similarities yet diverge in key respects due to differences in their scope and objectives. The WFD, which concentrates on inland waters - including rivers, lakes, transitional and coastal zones, features a governance model that is more locally and regionally oriented. It is primarily coordinated by the Department of Housing, Local Government and Heritage and the Environmental Protection Agency (EPA), with local input from Local Authorities, the Local Authorities Waters Programme (LAWPRO) and Inland Fisheries Ireland (IFI), reflecting its emphasis on catchment-level management.

The governance structure is supported by several national committees such as the Water Policy Advisory Committee, National Coordination and Management Committee, National Technical Implementation Group and by five Local Authority regional structures, each comprised of a Regional Water and Environment Management Committee and a Regional Water and Environment Operational Committees, again reflecting the more localised focus of WFD implementation. The implementation of the directive is also supported by An Fóram Uisce, a platform for stakeholder engagement into water related policy formulation and decision making (Table 4-3).

In contrast, the MSFD addresses a broader and more complex set of environmental pressures across Ireland's entire marine area, including offshore waters. Its governance is therefore more nationally integrated and strategically aligned with international frameworks. The Department of Climate, Energy and the Environment leads MSFD implementation, supported by a MSFD National Steering Committee and thematic working groups[19] comprising of experts from government departments, state agencies, NGOs, and academic institutions. Moreover, the MSFD relies heavily on regional cooperation through conventions such as OSPAR, enabling harmonised methodologies and transboundary data sharing as well as facilitating joint assessments, monitoring and programme of measures between contracting parties.

Despite these differences, both directives are coordinated at the European level through the Common Implementation Strategy (CIS), ensuring consistency in reporting, monitoring standards, and policy alignment across member states. The work undertaken under the CIS framework across different working groups across both directives is overseen by the Strategic Coordination Group (SCG) for the WFD and Marine Strategic Coordination Group (MSCG) for the MSFD. These committees are made up of senior officials from member states including the national Water and Marine Directors from each member state and officials from the European Commission.

[19] To deliver the technical work required for MSFD Cycle 3, Thematic Working Groups may be established on an ad hoc basis by DHLGH depending on the work required for each part of the Marine Strategy. The work undertaken by these groups will be subject to oversight by a National Steering Group.

Table 4-3 Overview of Key Water and Marine Policy Committees in Ireland: Convening Bodies, Membership (non-exhaustive), and Purpose

Committees	Convened By	Membership	Purpose
Water Policy Advisory Committee (WPAC)	DHLGH	DHLGH, EPA, LAWPRO, Uisce Eireann, OPW, IFI, GSI, CRU, HSE, DAFM, NPWS, Dept. Health, CCMA, Water Forum (AFU)	Advises the Minister on WFD and water resource policy
National Coordination and Management Committee (NCMC)	DHLGH	DHLGH, EPA, LAWPRO, Regional Chairs	Oversees RBMP implementation
National Technical Implementation Group (NTIG)	EPA	DHLGH, EPA, LAWPRO, DAFM, Teagasc, Marine Institute, Coillte, IFI, GSI, SFPA, CCMA, NPWS, Waterways Ireland, HSE, OPW, UE, Northern Ireland Environment Agency, ACP, TII.	Addresses technical implementation issues
Regional Water and Environment Management Committees	Local Authority Chief Executives	DHLGH, EPA, LAWPRO, LAs.	Coordination of water quality management issues across each of the five regions
Regional Water and Environment Operational Committees	Local Authority Directors of Services	EPA, LAWPRO, Teagasc, Marine Institute, IFI, SFPA, NPWS, Waterways Ireland	Coordination of technical issues across each of the five regions
An Fóram Uisce	Chair of An Fóram Uisce	Broad membership from across sectors such as agriculture, environment, business, angling, fisheries, forestry, education, rural water and others	Advise the Minister on water policy and management in Ireland
WFD Strategic Coordination Group (SCG)	European Commission	National Water Directors and other senior officials of the European Commission	Coordinates the overall implementation of the WFD and oversees the work of the thematic groups.
MSFD National Steering Committee	DECC	DECC, DHLGH, NPWS, Marine Institute, EPA, DAFM, SFPA, DoT, DECC, IFI, FSAI, IFI, BIM, NBDC and NGOs	Provides guidance and oversight in the implementation of the MSFD in Ireland
Marine Strategic Coordination Group (MSCG)	European Commission	National Marine Directors and other senior officials of the European Commission	Coordinates the overall implementation of the MSFD and oversees the work of the technical and working groups.
Various working groups and thematic committees of OSPAR	OSPAR	Representatives from contracting parties, the European Commission and other Regional Sea Conventions.	Technical and thematic support for MSFD implementation.

4.8 Integrated Catchment Management

Integrated Catchment Management (ICM) is a cornerstone of WFD implementation in Ireland and its role in delivering better outcomes for water quality is mentioned throughout Ireland's Water Action Plan 2024. The Plan outlines a comprehensive strategy for implementing Integrated Catchment Management (ICM) including the development of **Catchment Management Work Plans** for each catchment which will develop into fully integrated frameworks for managing water quality at the catchment level and will be used to track progress in water quality improvements. The 3rd WAP also includes an action for the development of Sectoral Action Work Plans (SAWPs) which will identify how individual sectors such as agriculture, forestry and wastewater will reduce the pressures from their own sectors. The ICM strategy will be governed by a new Programme Delivery Office within the Department of Housing, Local Government and Heritage, with the Regional Operational Committees coordinating actions across agencies and sectors. The principle of **"the right measure in the right place"** will guide the overall approach and measures will be informed by data and risk assessments to ensure resources are focused where they will have the greatest impact.

4.9 Integrated Coastal Zone Management

While Ireland has no dedicated national Integrated Coastal Zone Management (ICZM) policy, the development of Ireland's marine strategy under the MSFD and the establishment of the Maritime Area Regulatory Authority (MARA) represents a significant step towards improved integration.

In particular, the establishment of MARA represents a major reform of marine governance in Ireland consolidating previously fragmented responsibilities under a single authority. MARA is now responsible for consenting the 'right to occupy' marine space through the granting of Maritime Area Consents (MACs) and the 'right to use' through licensing of specified activities through the granting of Maritime Usage Licences (MULs).

MARA is a key player in implementing the National Marine Planning Framework (NMPF) and creating a coherent marine planning system through its support for the establishment of Designated Maritime Area Plans (DMAPS) and coordination with Ireland's main independent statutory planning authority - An Coimisiún Pleanála. It also provides a gateway function for planning applications through the Maritime Usage Consents process.

Through its new enforcement powers MARA ensures that applicants and licence holders adhere to the conditions of MACs and MULs thus supporting the sustainable use and protection of marine resources, a key goal of the WFD and MSFD and consistent with the principals of ICZM.

As part of the Marine Usage Licence application process, MARA requires applicants to demonstrate how their proposed activity aligns with the objectives of the National Marine Planning Framework (NMPF). Applicants must also submit an Appropriate Assessment (AA) screening report, unless the activity is directly related to the management of a European site of conservation importance. Additionally, a risk assessment for Annex IV species, which may occur outside designated European sites, is required.

To ensure environmental coherence, MARA requests sufficient information to assess whether the proposed activity is consistent with the objectives of both the WFD and the MSFD and whether or not the activity should be subjected to a full Environmental Impact Assessment (EIA). If an EIA is deemed necessary, the applicant must apply for a Marine Area Consent (MAC).

Furthermore, applicants must provide a further statement of consistency to address how their activity is consistent with achieving the National Climate Objective, as defined in the Climate Action and Low Carbon Development Act 2015, and demonstrate consistency with the 4th National Biodiversity Action Plan 2023–2030, as well as other relevant national and EU environmental strategies and objectives.

As such, MARA, having evaluated this information, should be well-equipped to make well-informed decisions regarding which activities to permit or reject. The quality and relevance of the data provided by applicants will help ensure that decisions are grounded in science and policy and should result in much better management and integrated governance of activities in Ireland's marine environment.

To the best of our knowledge a similar **Statement of Consistency** approach is not used when considering land-based permit or planning applications for proposed activities which may interact with the objectives of the WFD or indeed other national and EU environmental strategies and objectives which are not assessed as part of existing regulatory assessments. As such one of the recommendations from this research will be to incorporate a Statement of Consistency approach for land-based activities.

While MARA plays a pivotal role in marine spatial planning, its involvement in broader aspects of integrated coastal management, particularly at the land-sea interface, is more limited. Additionally, within the MAC process, environmental assessments are primarily undertaken by other bodies such as An Coimisiún Pleanála, rather than MARA itself.

Nonetheless, the establishment of MARA represents a significant improvement in marine governance in Ireland particularly in the area of marine spatial planning and in the sustainable use and enforcement of maritime space.

Indeed, if a national integrated coastal management policy is developed it is likely that MARA will play a central role in the implementation and operation of any such policy.

In the short term, however, MARA's existing role in marine governance could be further strengthened by the development of clear guidance for developers in completing a Marine Usage Licence application. Such guidance would promote consistency, transparency, and informed decision-making, ensuring that responses to MARA's technical and policy-related information requests are robust and evidence-based. This, in turn, would enhance the overall quality of applications received and streamline the regulatory process.

Indeed, clear guidance of the specific requirements of a Water Framework Directive compliance assessment would also be highly beneficial not just for the purpose of MARA applications but more widely for other activities which now require this type of assessment. The WFD establishes a legal obligation to prevent deterioration of water body status and to achieve good ecological and chemical conditions in coastal and transitional waters. Therefore, clear instructions on the data requirements, assessment methodologies, and mitigation measures necessary to demonstrate WFD compliance would help developers understand their responsibilities and integrate these considerations early in project planning. Such guidance would help reduce uncertainty and improve the quality of submissions and not only support MARA in meeting its obligations under the WFD, but the obligations of all relevant competent authorities in this matter.

4.10 Strategic Review of WFD and MSFD Interactions

In the sections above a detailed description of the nature of the interactions between the WFD and MSFD has been given. In this section, this information is used to undertake a SWOT analysis to provide a strategic review of how these interactions can be used to better manage transitional and coastal waters. By examining their strengths, weaknesses, opportunities, and threats across key thematic areas, including objectives, geographic scope, monitoring programmes, programme of measures and governance, this analysis seeks to identify synergies and challenges that influence the effectiveness of water and coastal management in Ireland. The outcome of the SWOT analysis is shown in Table 4-4.

Table 4-4 SWOT Analysis of the Alignment Between the Water Framework Directive (WFD) and the Marine Strategy Framework Directive (MSFD)

Feature	Strength	Weakness	Opportunity	Threat
Objectives	Both directives aim to protect and enhance aquatic ecosystems through ecosystem-based management and public participation	The fact that both directives express their core status objective using the same acronym GES may potentially result in confusion	Alignment of objectives can foster joint research, monitoring, and stakeholder engagement initiatives, reducing duplication and improving efficiency	If integration efforts stall or are absent, objectives may be pursued in isolation, weakening overall environmental outcomes
Geographic Scope	Coastal waters are covered by both directives, allowing for shared data and assessments.	Potential for confusion and duplication	Sharing of resources	Overlapping scopes and differing definitions may lead to duplication or gaps in implementation
Criteria, indicators, standards and methodologies	Applied across both directives Extensive number of criteria, indicators, standards and methodologies	Gaps in standards and indicators (e.g. hydromorphological standards for the WFD and indicators for MSFD (e.g. for non-indigenous species, bycatch)	Sharing of data between directives Fill remaining gaps	Delays in updating standards and indicators could hinder progress
Monitoring Programme	Comprehensive, co-ordinated and technically robust programmes in place Programmes meet the obligations of both directives MSFD adopts a more co-ordinated approach (includes WFD, CFP, OSPAR surveys programmes)	WFD programme does not explicitly reference the MSFD Potential duplication of effort given the complexity of both programmes Gaps in programmes for both directives	Greater alignment in programmes design, data collection and data sharing Alignment of reporting obligations Joint planning workshops Integrated data platforms to support more holistic understanding of aquatic and ecosystem health	Duplication and inefficient use of resources Climate change
Programme of Measures	Measures common to both directives identified in each others PoMs although measures of relevance to MSFD not explicitly identified in WFD PoMs	MSFD not directly referenced in WFD PoMS indicating lack of integration and coherence Non-aligned reporting cycles	Aligning PoMs across directives could enhance coherence and cost-effectiveness Increased cross-directive coordination	Hinders strategic planning
Governance	National and European steering committees and	Multiple departments and agencies involved	Significant opportunity to improve cooperation and coordination	Fragmented governance

	technical groups exist for both directives, enabling coordination. Local and regional governance particularly strong in WFD	with limited cross-directive coordination	through the introduction of overarching governance structure which could reduce duplication and highlight key operational and implementation links	
Policy Alignment	MSFD environmental targets reference WFD actions (e.g. Water Action Plan 2024)	No statutory Integrated Coastal Zone Management (ICZM) strategy in Ireland	A national ICZM policy could bridge land-sea governance and improve integration Improve stakeholder engagement	Fragmented governance and policy alignment
Citizen Science Integration	MSFD monitoring includes long-standing citizen science initiatives	No reference to role of citizen science in WFD monitoring	Enhanced public engagement, understanding and data collection	Lack of public engagement

The SWOT analysis highlights that while the WFD and MSFD share complementary objectives and offer opportunities for resource sharing and integrated monitoring, their interaction is hindered by fragmented governance, non-aligned reporting cycles, and gaps in cross-directive coordination. Strengths such as robust monitoring programmes and shared environmental targets are offset by weaknesses including duplication of effort particularly in relation to reporting obligations. Despite the lack of alignment in reporting timelines, there may be scope to explore shared reporting and assessment processes. For instance, could the economic analysis component be jointly reported under both directives?

Opportunities exist to enhance integration through joint planning, data platforms, and a national ICZM strategy, but threats such as climate change and inefficient resource use underscore the need for strategic alignment. Overall, the analysis underscores the importance of fostering stronger institutional and policy linkages to realise the full potential of these directives in protecting aquatic and marine ecosystems.

4.11 Conclusion

The Water Framework Directive and the Marine Strategy Framework Directive share a common goal of protecting and enhancing aquatic ecosystems. In Ireland, both directives are well-established and supported by robust monitoring programmes, governance structures, programmes of measures and cooperation between multiple governmental departments, agencies and other public authorities. However, despite thematic and geographic overlaps, particularly in coastal waters, their implementation remains largely parallel, with limited formal integration.

The analysis presented in this chapter highlights several areas of strength, including shared environmental targets, comprehensive monitoring, use of standard methodologies and existing water standards and indicators. Yet, it also reveals critical weaknesses such as fragmented governance, non-aligned reporting cycles, and the absence of explicit cross-referencing between directives in key areas such as the development and implementation of measures.

Irish authorities could enhance the implementation of both the WFD and MSFD by examining successful approaches adopted by other EU member states. A notable example is Finland, which undertook a comprehensive review of its governance and management structures for both directives[20]. This led to the establishment of a fully integrated framework that promotes stronger coordination and cooperation between the WFD and MSFD.

The Finnish model demonstrates how integrated governance can significantly improve strategic planning and decision-making. Key features include a joint steering group, national and regional cooperation structures, and a unified implementation plan that clearly outlines the interconnections between the two directives.

Ireland could benefit from adopting a similar integrated approach. By aligning governance structures, planning cycles, and data platforms, Ireland can strengthen the coherence between WFD and MSFD implementation, improve policy efficiency, and better respond to emerging environmental challenges such as climate change and marine biodiversity loss.

[20] Management of water resources and marine environments in Finland https://ym.fi/en/management-of-water-resources-and-marine-environments-in-finland

5. Overall Conclusion and Policy Recommendations

Ireland's transitional and coastal waters are facing increasing pressures that challenge their ecological integrity and sustainable management. While significant progress has been made through the implementation of the Water Framework Directive and the Marine Strategy Framework Directive, the analysis in this report highlights persistent gaps in integration, coordination, and strategic alignment. Addressing these challenges requires a more coherent approach that bridges freshwater and marine governance, strengthens cross-directive collaboration, and supports evidence-based, site-specific management. The following recommendations set out practical steps to enhance policy coherence, improve environmental outcomes, and support a more integrated catchment-to-coast management framework that takes into account the ecological complexity of these waters.

5.1 Recommendations

1. Develop an Integrated Nutrient Management Strategy

Implement a dual-nutrient management approach that addresses both nitrogen and phosphorus to effectively control eutrophication along the freshwater–marine continuum. Historically, efforts have concentrated on reducing phosphorus in freshwater systems, which has altered N:P ratios and inadvertently increased nitrogen export to vulnerable coastal waters. Future strategies must account for the shift in nutrient limitation - from phosphorus in freshwater environments to nitrogen in marine systems. These strategies should be guided by system-specific ecological models and robust empirical data to identify the critical nutrients and the reduction targets necessary to achieve established management objectives.

2. Apply Targeted Measures Based on Local Conditions

Advance the principle of **"the right measure in the right place**" by aligning planned actions with the expected ecological response. For transitional and coastal waters, incorporate key factors that influence this response such as water residence time, light penetration, nutrient balance, and ecological interactions - when developing mitigation strategies. Recognize that some systems are inherently less sensitive to nutrient enrichment than others and ensure that interventions are targeted toward those areas where they will deliver the greatest ecological benefit.

3. **Strengthen Scientific Understanding**

Continue to invest in research that helps to understand the complexity of the processes which determine the scale and extent of eutrophication in estuarine and coastal waters. Prioritise studies on how climate change may increase vulnerability to nutrient enrichment and alter ecological dynamics along the freshwater–marine continuum.

This research could focus on developing a **National Vulnerability Index for Nutrient Enrichment and Eutrophication (VI-NEE)** to identify transitional and coastal water bodies that are inherently more or less vulnerable to nutrient inputs, based on their physical, optical, and ecological characteristics. This index would integrate multiple biophysical indicators to provide an accessible, evidence-based, and spatially explicit tool for prioritising management interventions and to better understand the susceptibility of these waters to future climate-driven changes in nutrient pressures and impacts.

4. **Develop Site-Specific Action Plans**

Build upon existing knowledge and outputs of the previous recommendations to develop site-specific action plans to inform the development of targeted, locally appropriate management strategies that consider both upstream and downstream impacts. These should be integrated into the **Catchment Management Work Plans** under Ireland's Water Action Plan 2024.

5. **Establish a Joint Steering Group for WFD and MSFD Implementation**

Form a national-level body to oversee strategic alignment between the WFD and MSFD. This group should develop a **Combined Implementation Plan** that identifies key linkages across standards, indicators, monitoring, measures, data sharing, reporting and public engagement. Identifying linkages and aligning activities such as programmes of measures across the two directives would enhance coherence, reduce duplication and improve cost-effectiveness.

6. **Expand Citizen Science Across Both Directives**

Broaden citizen science initiatives under the WFD to match the MSFD approach. This will enhance public engagement, improve data collection, and foster greater awareness of water quality issues.

7. **Address Regulatory Gaps in Water Standards and Indicators**

Fill existing gaps in standards, targets and indicators across the WFD and MSFD. Finalise and legislate standards for hydromorphological elements in transitional and coastal waters to support better integration with WFD and MSFD hydrographical and hydromorphological assessments.

8. Adopt a Statement of Consistency approach for Land-based Activities

To ensure environmental coherence across both marine and terrestrial domains, it is recommended that a similar **Statement of Consistency** requirement as currently used by MARA be introduced for land-based activities. This statement should explicitly address how proposed activities align with the objectives of the Water Framework Directive (WFD) and other relevant national and EU environmental strategies.

9. Provide Clear Guidance for Developers and Regulators

Provide clear technical guidance to regulators and developers on how to assess project compatibility with the Water Framework Directive and Marine Strategy Framework Directive. This would have multiple benefits, including consistency in applications, improved legal compliance, reduced delays, improved stakeholder engagement and better-informed decision-making.

10. Introduce a Statutory Integrated Coastal Zone Management (ICZM) Strategy

Develop and implement a national ICZM policy to bridge land–sea governance and promote holistic ecosystem-based management.

This strategy should explicitly link with the Catchment Management Work Plans (CMWPs) under Ireland's Water Action Plan 2024. Each CMWP should not only address nutrient inputs from upstream catchments but also consider the expected ecological response within estuarine and coastal environments. Site specific modulating factors as highlighted above must be incorporated into planning to predict system sensitivity and guide targeted interventions.

By embedding ICZM and aligning it with WFD and MSFD objectives, Ireland can reduce fragmented decision-making and deliver more effective, integrated measures to protect water quality and biodiversity.

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