

Chapter 9: The Marine Environment





The Marine Environment

1. Introduction

The estuaries, coastal and marine waters of Ireland combine to extend to over 880,000 km². The area covered by water is more than ten times the land mass of Ireland. In recent years, there has been increased attention given to our marine areas, their constituent habitats and biodiversity, their natural resources and their energy generation potential. Marine areas can be damaged by human-induced pressures and pollution, whether of global origin (e.g. climate change, marine litter or fisheries) or of local origin (e.g. agriculture, industry or urban waste water). Although Ireland's offshore waters have generally been considered relatively clean and healthy, our nearshore coastal systems are under increasing pressure.

As our saline waters are very diverse and cover such a large area, they are assessed and managed in different ways. Estuaries and coastal waters are close to shore. Estuaries represent the interface between the freshwater environment (see Chapter 8) and ocean waters. These areas are very dynamic and highly variable in their salinity levels, tidal forces, freshwater inputs and exposure to the wider ocean environment. Water quality in estuaries is primarily managed under the Water Framework Directive (WFD; Directive 2000/60/EC); within the WFD, estuaries are referred to as transitional waters. These connect to coastal waters, which cover larger areas of greater salinity and extend to around 1 nautical mile offshore. The WFD sets out the management measures and assessment techniques required to assess these water bodies.

In the wider marine area, the Marine Strategy Framework Directive (MSFD; Directive 2008/56/EC) is the main legislation used to ensure that our seas are clean, healthy, biologically diverse and sustainably used. Figure 9.1 shows the WFD and MSFD areas. The MSFD requires the application of an ecosystem-based approach to managing human activities, enabling the sustainable use of marine resources, goods and services and the assessment of whether marine waters are achieving good environmental status (GES).

Figure 9.1 Water Framework Directive coastal and transitional water bodies and the Marine Strategy Framework Directive assessment area



Source: <https://atlas.marine.ie/>





In Ireland, the Department of Housing, Local Government and Heritage (DHLGH) is the lead body responsible for the implementation of the MSFD. The DHLGH is supported by several other government departments and state agencies. The Environmental Protection Agency (EPA), Marine Institute and National Parks and Wildlife Service (NPWS), among others, provide data and monitoring and support Ireland's delivery of the MSFD.

Implementation of the MSFD is through both national contributions and work undertaken regionally, in cooperation with other countries bordering the North-East Atlantic under the auspices of the OSPAR Convention (Topic Box 9.1).

The DHLGH also leads on the implementation of the WFD. The DHLGH is responsible for publishing and overseeing the River Basin Management Plans to ensure that all our surface water and groundwater achieve at least good status with no deterioration. The third River Basin Management Plan, Ireland's Water Action Plan (DHLGH, 2024a), was published in September 2024 and covers the period 2022-2027.

Aligned with the MSFD, the Maritime Spatial Planning Directive (2014/89/EU) also requires that an ecosystem approach be taken to marine planning in Ireland as part of the holistic management of activities in Ireland's waters. The directive is transposed through the Maritime Area Planning Act (2021) and Ireland's marine plan. The National Marine Planning Framework has also been in place since 2021. The Maritime Area Planning Act ensures the ongoing development of strong governance and licensing structures that mirror land planning. Table 9.1 outlines some of the key legislation governing the marine environment, although the full legislative system is very complex.

Topic Box 9.1 OSPAR Quality Status Report 2023



The OSPAR Commission is an international organisation working to protect the marine environment of the North-East Atlantic. OSPAR brings together 15 countries and the European Union to address environmental issues affecting the North-East Atlantic Ocean.

OSPAR is committed to safeguarding the marine environment for present and future generations. Its work highlights the interconnectedness of the ocean with climate change, human wellbeing and the overall health of our planet.

The OSPAR Commission's comprehensive *Quality Status Report 2023* (OSPAR, 2023a) assesses the environmental health and status of the North-East Atlantic Ocean and the effects of human activities on it.

The report is made up of more than 120 assessments (OSPAR, 2023a,b) and covers many aspects, including biodiversity, habitats and human activities that impact the marine environment. It examines the presence of contaminants and pollutants in the water, such as chemicals and microplastics, and assesses their potential effects on marine life and ecosystems.



Table 9.1 Key legislation governing the management and protection of the marine environment

Legislation	International/ EU/Ireland	Purpose
OSPAR Convention 1992	Int	Guides international cooperation on the protection of the marine environment of the North East Atlantic
Water Framework Directive (WFD) (2000/60/EC)	EU	Water quality in estuaries (transitional waters) and coastal water up to ~1 nautical mile from shore are primarily managed under the WFD
Marine Strategy Framework Directive (MSFD) (2008/56/EC)	EU	A European Union directive aimed at achieving or maintaining GES in European Seas. Represents the environmental pillar of the EU's Integrated Maritime Policy
Maritime Spatial Planning Directive (2014/89/EU)	EU	Promotes the sustainable growth of maritime economies, the sustainable development of marine areas and the sustainable use of marine resources. Requires that an ecosystem approach be taken to marine planning in Ireland as part of the holistic management of activities in Ireland's waters. Transposed through the Maritime Area Planning Act (2021)
Marine Planning Policy Statement (2019)	IE	Outlines a vision for the future development of our marine planning system
National Marine Planning Framework (2021)	IE	Outlines Ireland's vision, objectives and marine planning policies for each marine activity. Aligns with the principles of the OSPAR Convention
Maritime Area Planning Act (2021)	IE	An act to regulate the maritime area. Sets out functions of the Maritime Area Regulatory Authority

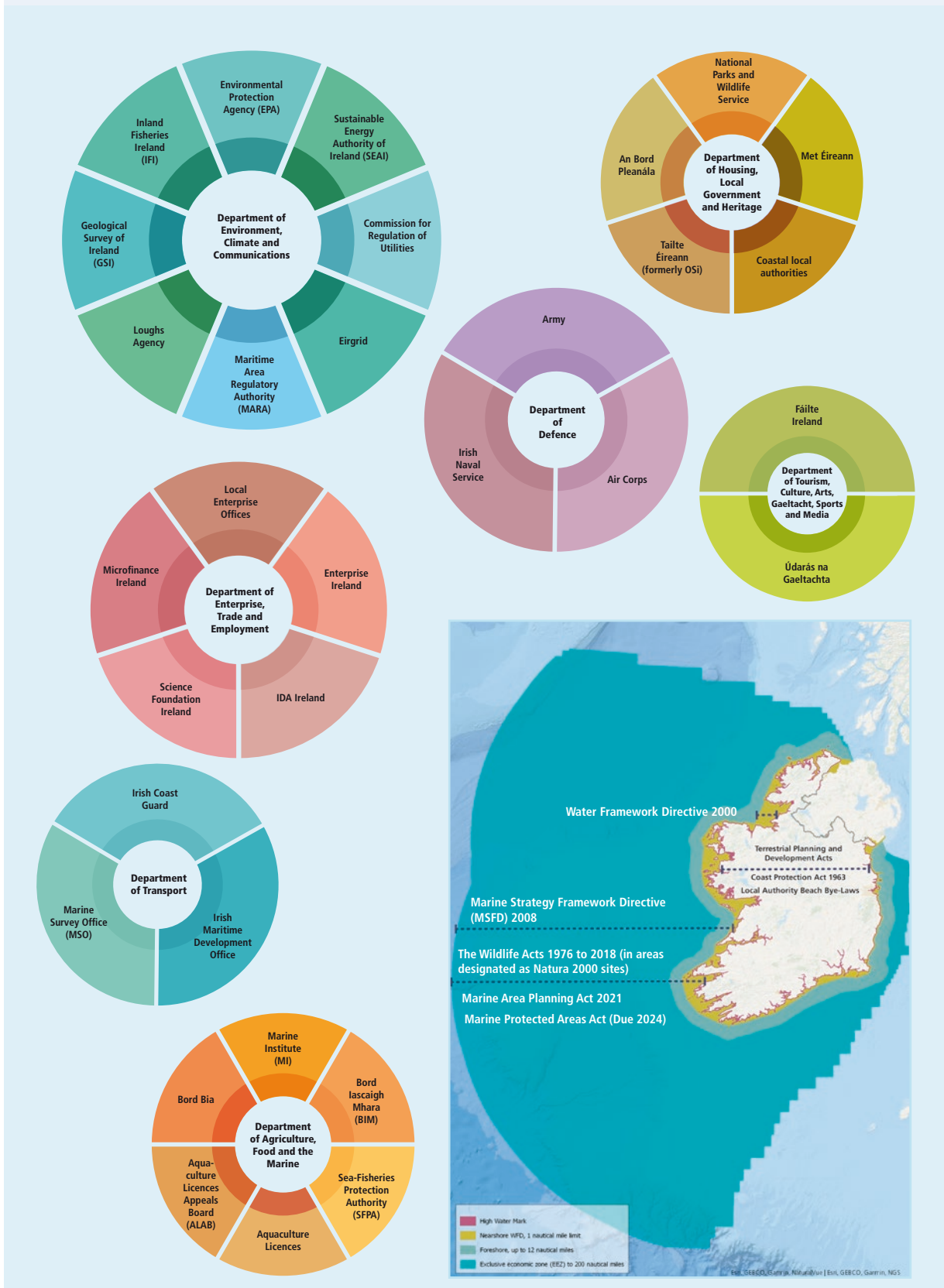
Overall, management of the maritime areas is divided across multiple government departments and agencies, with no one organisation having overall responsibility. This can lead to a lack of clarity on roles and responsibilities in the marine area (Figure 9.2) (O'Hagan *et al.*, 2020; Farrell *et al.*, 2023). Key organisations involved include the following: DHLGH, Department of the Environment, Climate and Communications, Department of Agriculture, Food and the Marine; Maritime Area Regulatory Authority (MARA), NPWS, EPA, Sea Fisheries Protection Authority, Inland Fisheries Ireland, Irish Maritime Development Office, Office of Public Works, Department of Transport, Department of Foreign Affairs. Increasingly, more responsibilities are now being delegated to other coastal local authorities.

In this chapter we present information on the status of Ireland's marine systems and discuss the primary human activities that exert pressure that may damage the environmental status of these waters. The main responses to these challenges are also discussed.





Figure 9.2 Government departments and public bodies with a remit in coastal and marine waters



Source: Adapted from Farrell *et al.*, 2023



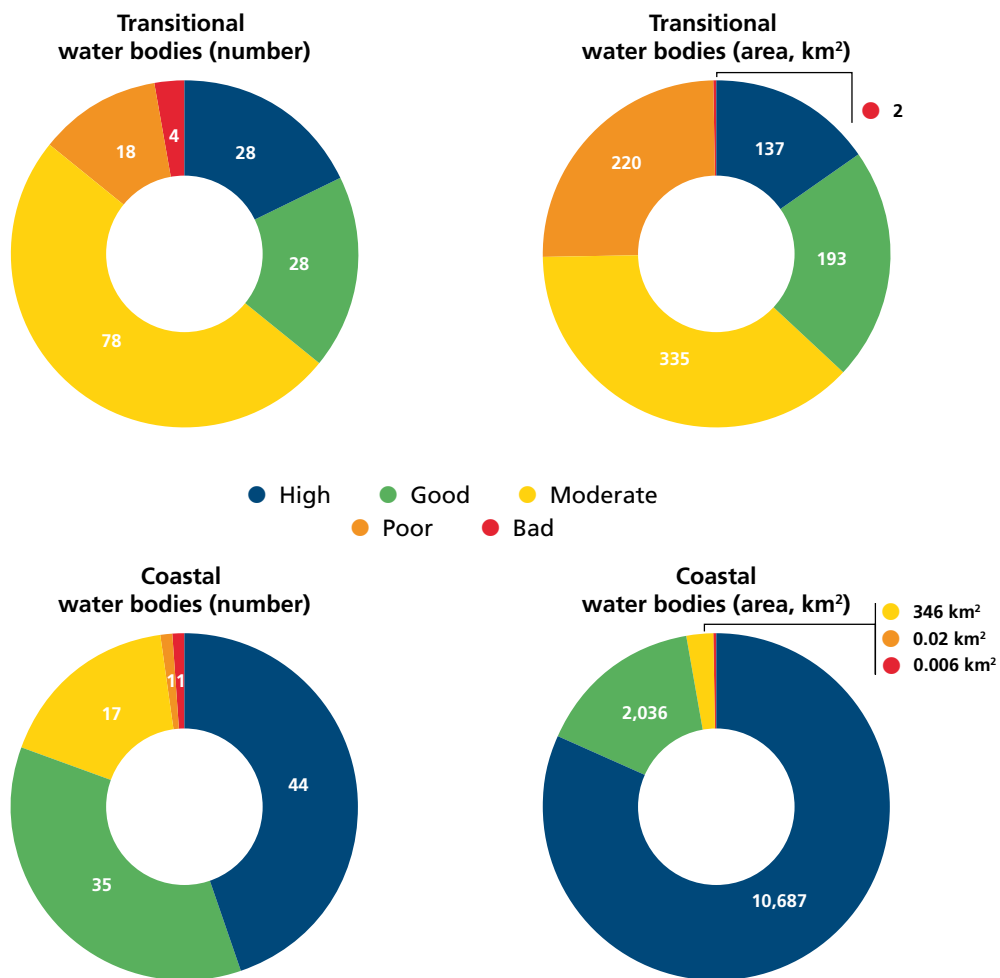
2. Current health of Irish marine waters

In 2022, the EPA published Ireland’s updated WFD status in *Water Quality in Ireland 2016-2021* (EPA, 2022). The report set out the latest assessment of the health of Ireland’s rivers, lakes, canals, groundwaters, and transitional (estuaries) and coastal waters. The assessment showed that over half (54%) of our surface waters are in satisfactory ecological health, being at either good or better ecological status. Coastal waters had the highest percentage of waters at high or good ecological status (81%), while estuarine waters had the worst water quality (36%).

Figure 9.3 shows that only 56 (36%) estuarine water bodies are at high or good ecological status and 100 (64%) are at moderate or worse ecological status and that 79 coastal water bodies (81%) are at high or good ecological status, with 19 (19%) at moderate or worse status. The majority (95%) of the surface area of coastal waters are at high or good ecological status.

Figure 9.4 provides a geographical representation of the status of our transitional and coastal waters. Transitional waters achieving less than good status are located primarily in the south and south-east of the country and include the estuarine reaches of the Bandon, Lee, Barrow, Nore, Suir and Slaney rivers.

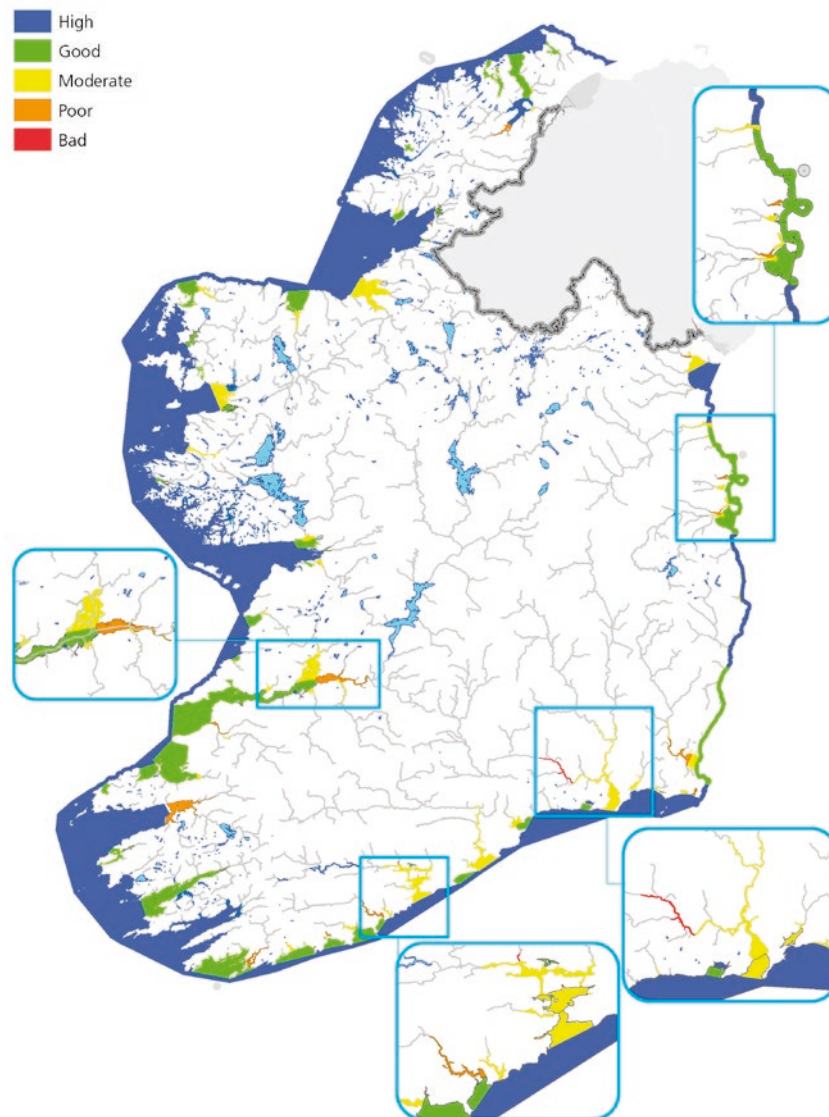
Figure 9.3 WFD status of transitional and coastal water bodies, 2016-2021, by number and by area



Source: EPA, 2022



Figure 9.4 Ecological status of transitional and coastal water bodies during 2016-2021



Source: EPA, 2022

Assessments under the MSFD are updated every 6 years. The latest draft assessment was published for public consultation in 2024 (DHLGH, 2024b). The draft assessment provides information on Ireland's assessment methodology for the required 11 environmental descriptors, their environmental targets and current status (Table 9.2).

The previous assessment, published in 2020, showed that Ireland's marine waters had achieved GES for five descriptors. Some but not all of the criteria for five further descriptors were of GES. There was not enough information to provide a complete assessment for descriptor 11 (EPA, 2020).

The results of the 2024 draft assessment are largely the same. They suggest that five descriptors have met GES, three have achieved GES for some elements but some information is still lacking and one descriptor (food webs) has insufficient information to assess its environmental status. There is now a better understanding of the status for descriptors 8 and 10 (contaminants and marine litter) due to the availability of more data and newly agreed assessment targets. (Table 9.2).



Table 9.2 Draft good environmental status (GES) assessment for the 11 MSFD descriptors (Source: DHLGH, draft publication)

Descriptor	Draft 2024 MSFD assessment
1. Biological Diversity	Achieved GES for some elements of biological diversity, but the status of many species groups is unknown. Numerous species, in particular a significant proportion of fish species, are not at GES
2. Non-indigenous species	Achieved GES
3. Population of commercial fish/ shellfish	GES has been achieved for 29 stocks of commercially exploited fish and shellfish. GES has not been achieved for 46 stocks, and the status of 99 stocks remains unknown
4. Elements of marine food webs	Environmental status for this descriptor remains unclear
5. Eutrophication	Achieved GES
6. Sea floor integrity	GES has been achieved for 75% of the MSFD areas; however, the status of 15% of the area remains unknown and approximately 11% has not achieved GES. Disturbance due to bottom trawling is widespread, with 40% of the MSFD assessment area affected to varying degrees
7. Alteration of hydrographical conditions	Achieved GES
8. Concentrations of contaminants	GES has been largely achieved for concentrations of most contaminants in seawater, sediments and biota in Irish coastal and marine waters. Concentrations of most parameters assessed are at levels that ensure the protection of the marine environment
9. Contaminants in fish/seafood for human consumption	Achieved GES
10. Marine litter	GES has not been achieved for marine litter
11. Introduction of energy including underwater noise	GES has been achieved for continuous and impulsive noise

Eutrophication status of marine offshore areas

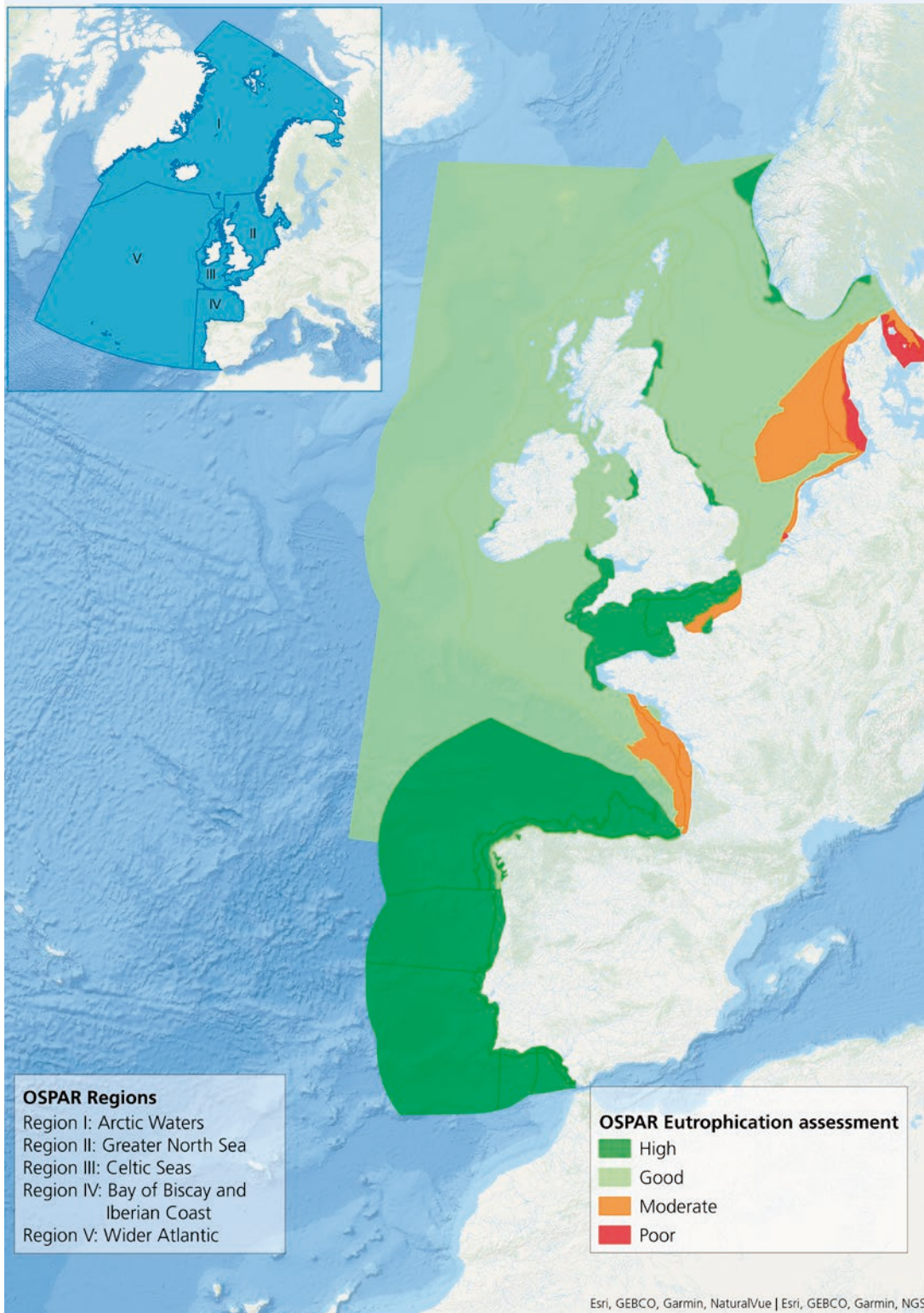
The OSPAR Convention was established to identify threats to the marine environment and develop programmes and measures to ensure effective national action to combat them. OSPAR's strategic objectives were updated in 2021 (OSPAR, 2021a) with the North-East Atlantic Environment Strategy 2030 (OSPAR, 2021b). Eutrophication in our marine water is assessed using methods developed under the OSPAR Convention, which covers the entire North-East Atlantic Ocean from Greenland to Portugal (Figure 9.5).

Eutrophication is the result of excessive enrichment of water with nutrients, which may accelerate the growth of algae in the water column. This may result in a range of undesirable disturbances in the marine ecosystem, including a shift in the composition of the flora and fauna (which in turn affects habitats and biodiversity), depletion of oxygen levels, changes in water clarity, and behavioural changes or even death of fish and other species.

The latest OSPAR assessment of eutrophication (OSPAR, 2023b), which covers regions II, III and IV, indicates that there are problem areas along the continental coasts and in the river plumes and coastal areas of the Bay of Biscay and in the greater North Sea (Figure 9.5). Eutrophication problems indicate that riverine nutrient inputs remain the major source. For Ireland, no eutrophic areas were observed in our marine waters, although significant problems remain in our transitional waters and some coastal waters (see Chapter 8).



Figure 9.5 Location of the five OSPAR regions comprising the OSPAR Maritime Area (inset) and the eutrophication status of marine areas in regions II, III and IV (main)



Source: Adapted from OSPAR, 2023b



Carrownisky Strand, Co. Mayo

Pollution status of marine offshore areas

OSPAR also assesses the levels and impacts of hazardous substances such as metals, pesticides and organic compounds in the marine environment.¹ Concentrations of many of the most serious hazardous substances, such as polychlorinated biphenyls and polyaromatic hydrocarbons (commonly known as PCBs and PAHs, respectively) and organochlorine insecticides, have decreased substantially compared with concentrations in the 1980s and 1990s. Concentrations of these substances in Ireland's marine environment generally do not exceed the thresholds used to assess environmental status, indicating GES. However, the concentrations of some legacy contaminants, specifically mercury and the antifoulant tributyltin (commonly known as TBT), do exceed the low thresholds applied in OSPAR assessments. The results of the draft 2024 MSFD assessment indicate some changes from the previous assessments where certain elements are above the assessment criteria, but this reflects the incorporation of additional parameters and revised thresholds rather than an actual deterioration in Ireland's marine quality.

A wide range of substances are monitored in coastal and transitional waters under the WFD to assess chemical status. Concentrations in water typically comply with environmental quality standards, indicating that harmful effects on aquatic life would not be expected (EPA, 2022).

Biodiversity

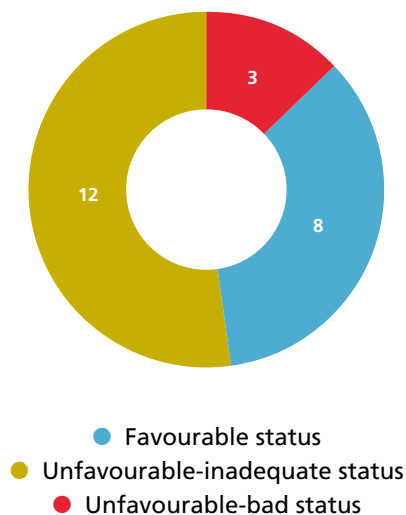
Since the most recent State of the Environment Report in 2020 (EPA, 2020), NPWS has published the fourth iteration of the National Biodiversity Action Plan (2024). The plan sets the national biodiversity agenda for the period 2023-2030 and aims to deliver the transformative changes required in the ways in which we value and protect nature.

Of the 23 coastal and marine habitat types designated under the Habitats Directive (Council Directive 92/43/EEC), eight were found to be in favourable status nationally (Figure 9.6), according to Ireland's most recent Article 17 report (NPWS, 2019) on the condition of our habitats and species. The remaining 15 types were at either unfavourable-inadequate (12) or unfavourable-bad (3) status. In particular, lagoons, large shallow inlets and bays, halophilous scrub and fixed dunes were at unfavourable-bad status and declining. The next update on the status of these habitats is due in 2025.

¹ OHAT – OSPAR Hazardous Substances Assessment Tool: dome.ices.dk/ohat/ (accessed 2 May 2024).



Figure 9.6 Status of Ireland's marine habitats



Source: NPWS, 2019

The draft 2024 MSFD update represents a much more comprehensive and internationally integrated assessment than earlier assessments, with many more species assessed under this descriptor. GES is being achieved for a few species in our marine waters, but the status remains unknown for many vertebrate species, including reptiles. For fish biodiversity, GES is also not being achieved in the Irish maritime area for any of the four species groups included in the assessment (coastal fish, deep-sea fish, demersal fish and pelagic fish). Regional assessments have now been carried out for ten mammal species (up from two small-toothed cetacean and two seal species assessed nationally in 2020). Among the mammals, GES continues to be achieved for one species (i.e. grey seal), but GES is not being achieved for two small cetacean species (i.e. harbour porpoise and common dolphin), both of which are subject to incidental by-catch, which is assessed through a coordinated regional approach.

In September 2023, Ireland signed the United Nations Biodiversity Beyond National Jurisdiction Agreement (UN, 2023), also known as the High Seas Treaty, to promote the conservation and sustainable use of marine biological diversity in areas beyond national jurisdictions.

Further information on wider biodiversity issues and the policy and legislation covering this area is found in Chapter 7.

Marine protected areas

The use of spatial conservation measures to protect the marine environment and its natural integrity and ecosystems is a key measure called for in the MSFD and the Nature Directives (Habitats Directive and Birds Directive) and under the UN Convention on Biological Diversity. In this regard, delivering Ireland's ambition for its marine protected areas (MPAs) is a key action to help meet our commitment to protect 30% of our marine areas by 2030 (DHLGH, 2023a). While the proportion of our waters currently designated as protected marine sites has increased from 2.3% to over 9%, this is still a long way from meeting that commitment.

It is important that marine developments do not occur at the expense of the wider marine environment, and the delayed MPAs legislation is essential in this regard. As part of a process to identify, designate and manage Ireland's network of MPAs, the government approved the General Scheme of the Marine Protected Areas Bill in December 2022. The legislation is now being drafted. It is anticipated that the Bill will be brought to government for approval to publish in 2024. The forthcoming legislation includes provision for an Ocean Environment Policy Statement to be adopted by government and revised at least every 6 years. This will set out the national vision for the protection of the marine environment and for priorities for the designation of MPAs.

The area of marine waters and seabed protected by means of designations under the EU Nature Directives has increased from 2%, as reported in the 2020 State of the Environment Report (EPA, 2020), to almost 10%. Ireland designated two new special areas of conservation (SACs) for the protection of reef habitats² in 2022. The Porcupine Shelf SAC has an area of 14,795 km² and the Southern Canyons SAC covers 14,434 km². Of the 27,000 Natura sites across the EU, the new SACs are the fourth and fifth largest.

Two further Special Protection Areas (SPAs) were also recently designated. (Topic Box 9.2). The level of protection is unclear, as the management measures are yet to be put in place for all areas. The EU Biodiversity Strategy for 2030 calls for at least 10% of each Member State's marine environment to be strictly protected; however, this commitment has yet to be included in any EU or national legislation.

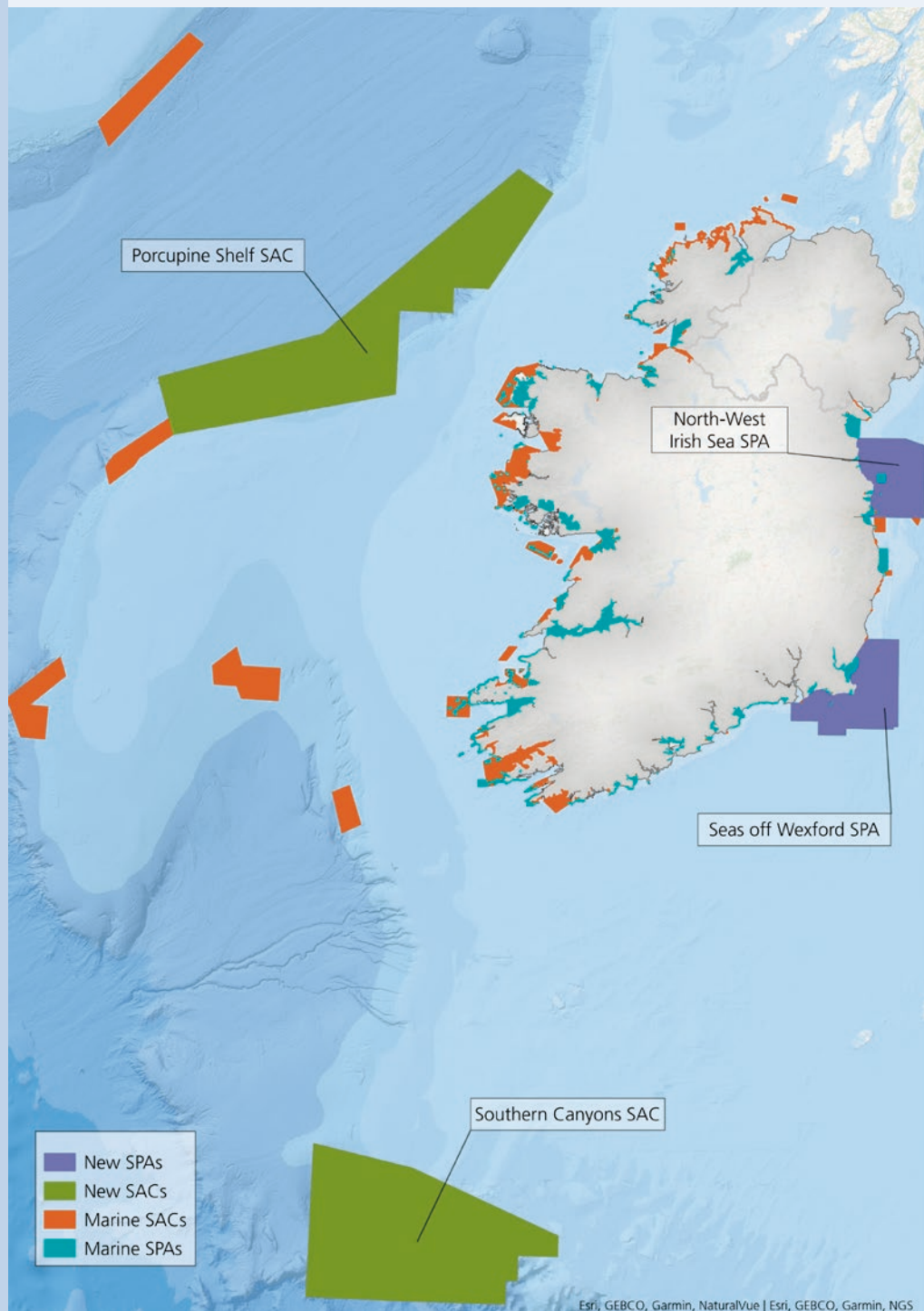
2 www.gov.ie/en/publication/e5057-notice-of-intention-to-designate-porcupine-shelf-002267-and-southern-canyons-002278-as-special-areas-of-conservation (accessed 10 June 2024).



Topic Box 9.2 New special protection designations

The North-West Irish Sea Special Protection Area (SPA) was designated under the EU Birds Directive (2009/147/EC) in late 2023. It will cover more than 2300 km² of important marine waters for a range of bird species throughout the year. The Seas off Wexford SPA, designated in January 2024, is over 3000 km² in size and is the largest SPA in Ireland. The designation increases the percentage of Ireland's protected marine waters. Figure 9.7 maps Ireland's marine SPAs and SACs.

Figure 9.7 The boundaries of the new North-West Irish Sea and Seas off Wexford SPAs and the new Porcupine Shelf and Southern Canyons SACs





Bathing water

The Bathing Water Quality in Ireland Report for 2023 (EPA, 2024a) shows that the water quality at most of Ireland's bathing waters met or exceeded the appropriate standards: 77% of bathing sites had 'excellent' water quality, while 97% met the minimum standard. This represents an improvement since the EPA's 2020 State of the Environment Report period, when 95% of waters met the criteria. It is also higher than the current EU average of 96% (EEA, 2024). The number of designated bathing areas has slightly increased also, from 147 in 2019 to 148 in 2023; the public can suggest new bathing waters to local authorities for designation each year.

3. Drivers, pressures and impacts

Marine fisheries

Ireland's marine area is an extensive resource for seafood production. The value of fish and shellfish landed in Ireland was €507 million in 2022 (BIM, 2023a). However, fishing continues to be the primary threat to ecosystem health despite a decrease in fishing pressure since the 1990s (ICES, 2022b). The health of fish and shellfish populations is assessed under the MSFD. These assessments indicated that GES was achieved for 29 stocks (17%) of fish and shellfish assessed but not for 46 stocks (26%), with the environmental status of 99 stocks (57%) currently unknown (DHPLG, 2020). Slightly fewer stocks are achieving GES now than in 2020, while the number of unknown stocks remains the same.

Apart from the effects of the removal of targeted stocks, fishing practices can have an impact on the marine environment through the disturbance of seabed habitats and incidental by-catch (OSPAR, 2021c; ICES 2022a). The use or location of nursery and feeding habitats is still poorly understood, and many benthic (i.e. seabed) habitats, including reefs, are thought to have been severely damaged by bottom-contacting fishing gear. The MSFD status assessment of seabed disturbance shows that the extent and distribution of physical disturbance pressures on the seabed are significant (DHLGH, 2024b). Analysis of bottom mobile fishing data from 2010 to 2015 showed physical disturbance to be widespread, occurring to some degree in 64,865 km² (OSPAR Region III of Ireland's Marine Reporting Unit); some 13% of Ireland's reporting area. By-catch of mammals (in particular harbour porpoise, common dolphin and grey seals), seabirds and vulnerable species

of fish including elasmobranchs (sharks, rays and skates) remains a significant pressure (ICES, 2022c; Taylor *et al.*, 2022).

All sectors, including fisheries, are required to contribute to Ireland achieving its targets to reduce greenhouse gas emissions. Emissions arising from fuel use by the Irish fishing fleet, reported as an average of 1.03 tonnes carbon dioxide (CO₂) equivalent per tonne of fish landed, are low compared with the global average emissions of the seafood sector (1.7 t CO₂ eq/t) and those of other food-producing sectors (BIM, 2023b).

Ocean warming, sea level rise and ocean acidification

The ocean has absorbed more than 90% of the additional heat due to greenhouse gas emissions from human activities over the last five decades. It also absorbs about a quarter of annual anthropogenic carbon dioxide emissions to the atmosphere (von Schuckmann *et al.*, 2020; Friedlingstein *et al.*, 2022). This has mitigated the severity of climate change effects but has caused changes to the physical conditions and chemistry of the oceans that now threaten marine ecosystems and the services they provide (Wählström *et al.*, 2022).

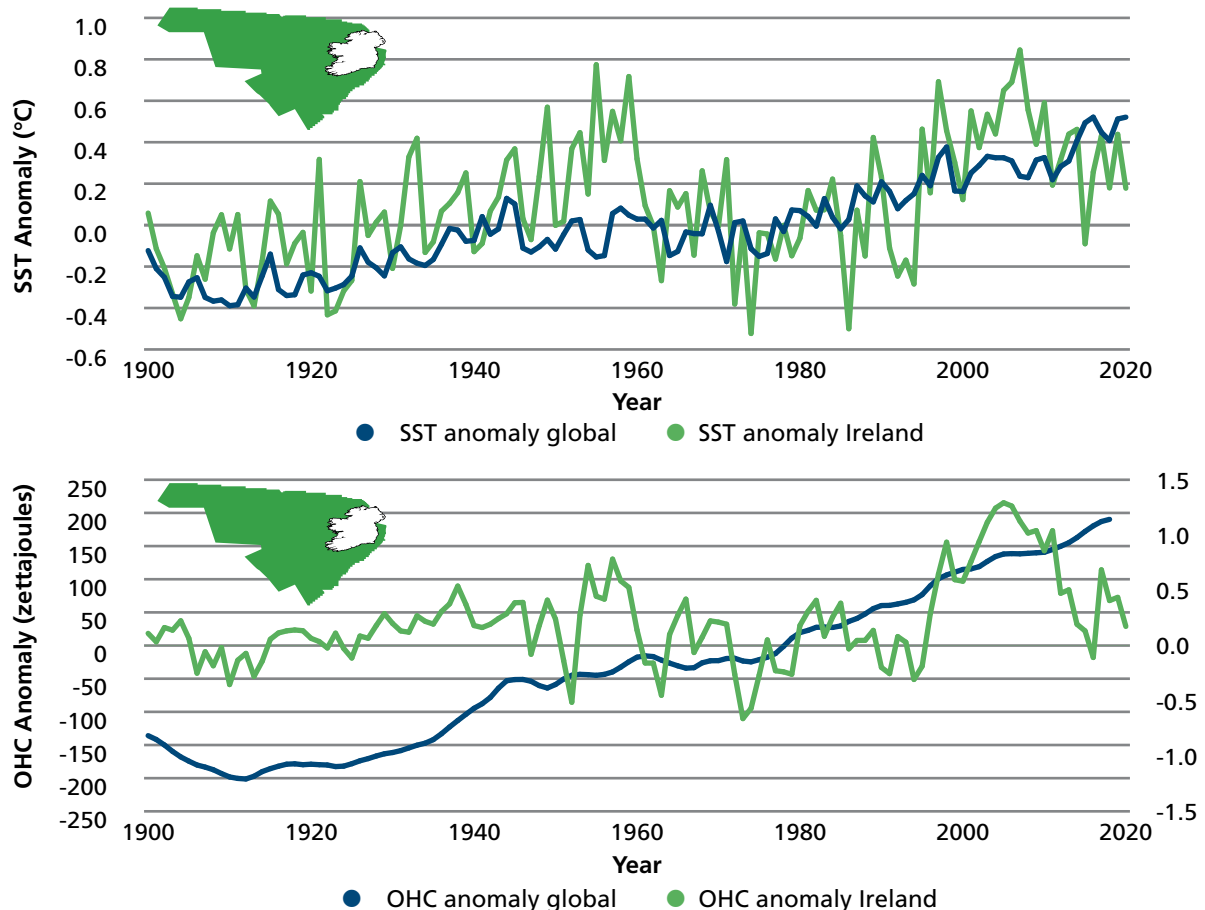
Sea level rise has been accelerating, with a global mean sea level rise of more than 9 cm since 1993, primarily attributed to melting ice and thermal expansion of the oceans. Since the 1990s, satellites have shown increased rates of sea level rise with rates around Ireland of 2-3 mm per year, in line with global trends (Cámaro García and Dwyer, 2021; McCarthy *et al.* 2023). Ireland also has a high-energy wind and wave climate. The coastal infrastructure and communities are under increasing threat from extreme sea levels, including storm surges, due to sea level rise and increased storminess (McCarthy *et al.*, 2023).

Global sea surface temperature increased at a rate of approximately 0.016°C per year from 1993 to 2020 (Figure 9.8), equating to an increase of approximately 0.43°C worldwide (von Schuckmann and La Traon, 2022). Ocean heat content³ continues to increase, and marine heatwaves are becoming more intense and frequent (Cheng *et al.*, 2022; IPCC, 2023; Nolan *et al.*, 2023). The mild Irish climate is dominated by the Atlantic Meridional Overturning Circulation or Gulf Stream system. A weakening of the Atlantic Meridional Overturning Circulation is considered very likely this century and is a large source of uncertainty in climate models (McCarthy *et al.*, 2023).

3 Ocean Heat Content (OHC) – the sum of the heat energy stored in the ocean.



Figure 9.8 Global (blue) and Irish waters (green) sea surface temperature (SST) anomaly (top). Global (blue) and Irish waters (green) ocean heat content (OHC) anomaly (bottom). Anomalies are calculated relative to the period 1960-1990. Inset highlights in green the 'Real Map of Ireland' – the limits of Irish waters used here



Source: Nolan *et al.*, 2023

The uptake by the oceans of anthropogenic carbon dioxide emissions also leads to acidification. The pH (the scale used to specify the acidity or basicity of an aqueous solution) of Irish waters has been declining over the last four decades (McGovern *et al.*, 2023). Ocean acidification will continue and even accelerate under the higher carbon dioxide emission scenarios. Certain marine organisms that build calcium shells or skeletons, such as shellfish and cold-water coral (*Desmophyllum pertusum*) reefs, will be vulnerable to ocean acidification.

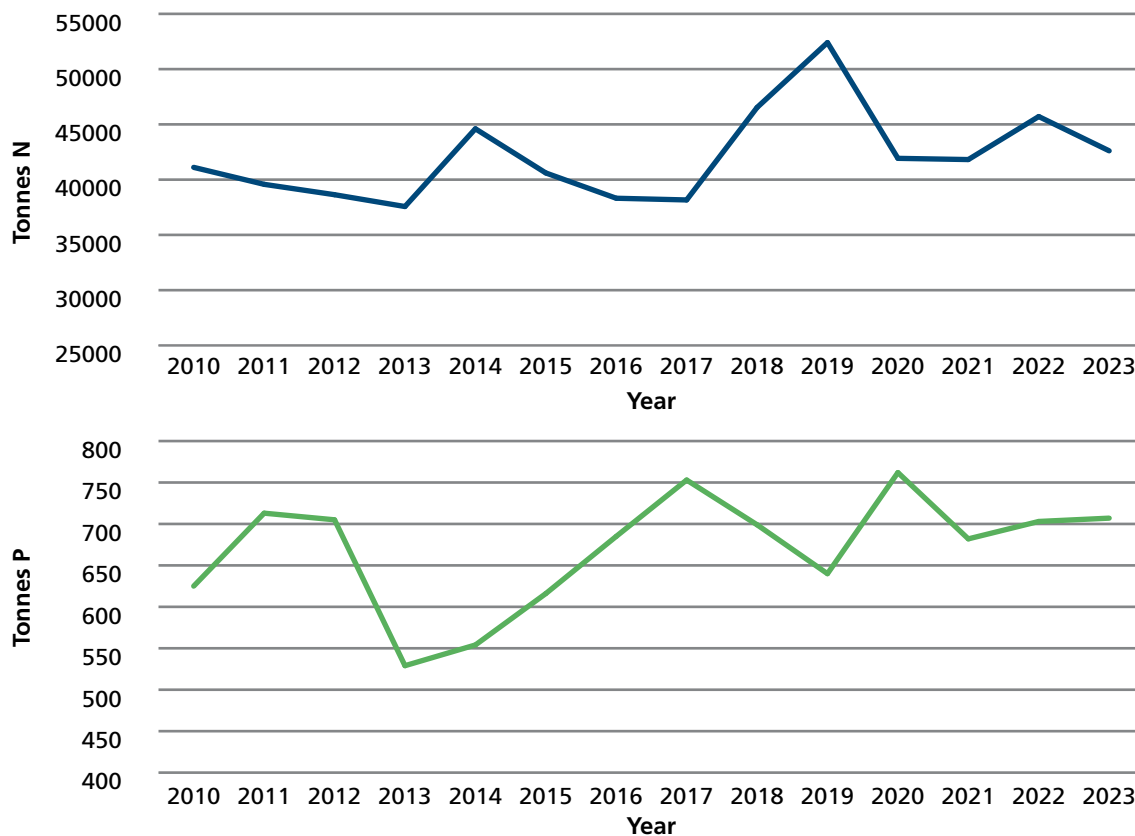
There have been changes in marine ecosystems, such as in the seasonality and abundance of many species including phytoplankton and zooplankton at the base of the food web. Globally, climate change is leading to a poleward expansion of many species. There is evidence of an increase in the presence of warm-water species to the south of Ireland. However, for fish and seabirds, disentangling climate effects from other pressures on populations, including fishing, remains a challenge (Nolan *et al.*, 2023; Vaughan *et al.*, 2023).

Nutrient enrichment

The assessment of nutrient enrichment in marine waters shows that eutrophication is not an issue in our offshore waters. However, in the seas closer to shore this is not always the case. Assessment under the WFD has shown that 64% of our estuaries are at moderate status. In particular, no estuaries on the south coast are at a status higher than moderate (EPA, 2021). The primary driver of environmental status is nutrient enrichment. The OSPAR Inputs of Nutrients to the OSPAR Maritime Area programme has been tracking the loads of different parameters from land-based activities reaching the marine environment since the 1990s (Axe, 2022). For Ireland, large decreases in nitrogen and phosphorous inputs were observed, and these continued to decline until around 2013 (EPA, 2024). Since then, the inputs of nutrients have increased (Figure 9.9), and these are largest in the rivers entering the sea along the south and south-east coasts of Ireland.



Figure 9.9 Trends in Ireland’s total oxidised nitrogen (N) loads (top) and phosphate (P) loads (bottom) entering the marine environment (Source: EPA, 2024b)



Increases in nutrients as a result of human activities, such as agriculture and waste water production (domestic and urban), are the primary driver of the decline in the status of our estuaries. Nutrient enrichment has serious impacts in these areas, including large accumulations of seaweed, phytoplankton blooms and declines in oxygen conditions (Figure 9.10). Recent assessments (EPA, 2021, 2022, 2023, 2024b) indicate that these impacts are also being observed in coastal waters, suggesting that the persistence of these nutrient inputs may cause wider issues in the marine environment.

Figure 9.10 Impact of nutrient enrichment on Clonakilty Bay

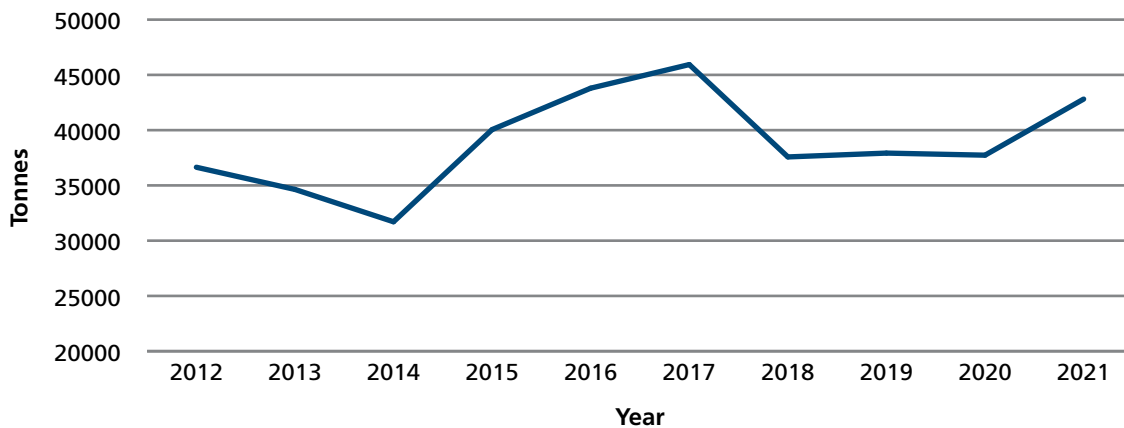




Aquaculture

The Irish aquaculture sector's output in 2022 was worth €196 million and mainly consisted of oysters, mussels and salmon production (BIM, 2023a) (Figure 9.11).

Figure 9.11 National total tonnage of Irish aquaculture output, 2012-2021



Source: BIM, 2023a

Aquaculture operations can potentially affect the marine environment, such as through escaped farmed salmon, the spread of pathogens and parasites to native populations, and the potential disturbance to and displacement of fish, shellfish, birds and other wildlife populations. The accidental introduction of non-native species, together with water pollution, aquaculture and other activities, is considered a pressure for a number of protected habitats (NPWS, 2019; OSPAR, 2021d; ICES, 2022a).

Aquaculture is also at risk of environmental pressures. Ireland has 64 designated shellfish growing areas, which have specified water quality requirements to support shellfish production. The risks from pollution risks to shellfish production and environmental health are discussed in Chapter 14.

Dredging and dumping at sea

The removal of seabed material for maintenance and navigational purposes is a common occurrence in ports and harbours around Ireland. The disposal of this dredged material at sea can only occur under a Dumping at Sea Permit granted by the EPA. Such permits are also required for the removal and dumping of dredged material to facilitate infrastructural expansion (capital projects). Permit returns show that, in 2023, approximately 1.3 million tonnes (wet weight) of material, arising mainly from maintenance projects, were dredged and deposited at eight licensed disposal sites around the Irish coast. In Dublin Port, capital works

commenced as part of the MP2 Project⁴ which is being carried out under Dublin Port's Masterplan 2040 to increase the port capacity. The permitting process ensures that dumping is a localised pressure and contaminated sediments are not dumped at sea. Assessments under the MSFD indicate that dumping is not having widespread or long-term effects on the wider ecosystem.

Underwater noise

Sound is a by-product of human activities in the marine environment (e.g. shipping or construction) or is produced intentionally for the purposes of surveying the seabed or water column. Sound is referred to as 'noise' only when it has the potential to cause negative impacts on marine life.

Anthropogenic sound sources are categorised as impulsive or continuous. A recent OSPAR assessment looked at impulsive sound sources in the North Sea area, which include percussive pile driving for inshore and offshore construction, seismic surveys to map subsea oil and gas deposits, explosions and some sonar sources (OSPAR, 2023c). This has shown that impulsive sound sources have caused temporary displacement of small cetaceans (e.g. harbour porpoise), increased physiological stress in some fish species (e.g. European seabass) and caused developmental abnormalities in invertebrate larvae. In some cases, they may also be capable of causing more severe effects such as permanent auditory damage or blast injuries.

4 www.dublinport.ie/masterplan/mp2/ (accessed 2 May 2024).



The status of underwater noise in Ireland's marine environment is based on an analysis of the spatial and temporal patterns of sound sources, a modelling approach for impulsive noise and a risk-based approach for continuous noise.

In 2022, threshold values for the spatial and temporal extent of underwater noise were agreed at an EU level (Borsani *et al.*, 2023). This has allowed Ireland to perform an assessment of the impacts of underwater noise. Vessel traffic is the main source of human-made continuous noise in the Irish marine environment. Impulsive noise includes sources such as percussive pile driving, seismic surveys, explosions and some sonar sources. Analysis of underwater noise using information from the OSPAR Impulsive Noise Registry indicates that Irish marine areas fall below agreed thresholds in the years assessed.

Offshore energy

Ireland has committed to achieving a target of at least 5 GW of installed offshore wind capacity in its maritime area by 2030 within the Climate Action Plan 2024 (DECC, 2023). The plan also sets out a further commitment that up to 80% of Ireland's electricity will be from renewable sources by 2030.

Offshore renewable energy will play a significant role in advancing Ireland's environmental commitments towards achieving climate neutrality by 2050. The process for developing this is included in the draft Offshore Renewable Energy Development Plan II, which was published for public consultation in April 2023 (DECC, 2023). It is important that the plan is closely aligned with the National Marine Planning Framework and the Maritime Area Planning Act 2021, so that, in delivering energy, other relevant sectors operating in the maritime area and impacts on the marine environment will be considered. The government is also currently consulting on the development of planning guidance for offshore wind energy. These guidelines will help clarify the requirements and organisational roles under the Maritime Area Planning Act, as they relate to offshore wind energy for different public bodies, as well as the environmental factors that need to be considered.

Developments must fully account for the relevant requirements of the WFD and MSFD. Where the potential for significant effects on water quality and biodiversity remains uncertain, even after mitigation measures have been applied, further environmental monitoring and research may be required. While not currently included in the draft Offshore Renewable Energy Development Plan II, the cumulative impacts from associated infrastructural and connection works must be fully considered. Where conflicts remain difficult to resolve, the overall benefit of the developments must be considered.

The state is working to identify appropriate locations for offshore wind development in consultation with local communities and with consideration for other maritime activities, including fishing and seafood production, and sensitive or protected habitats. In 2023 an ecological sensitivity analysis of the western Irish Sea was undertaken as part of a screening for species and habitats that may need protection under forthcoming MPA legislation. It identified areas of comparatively higher and lower ecological sensitivity based on the best available scientific evidence while concurrently providing information that could inform planning decisions that need to be taken about the potential siting of offshore renewables infrastructure.⁵

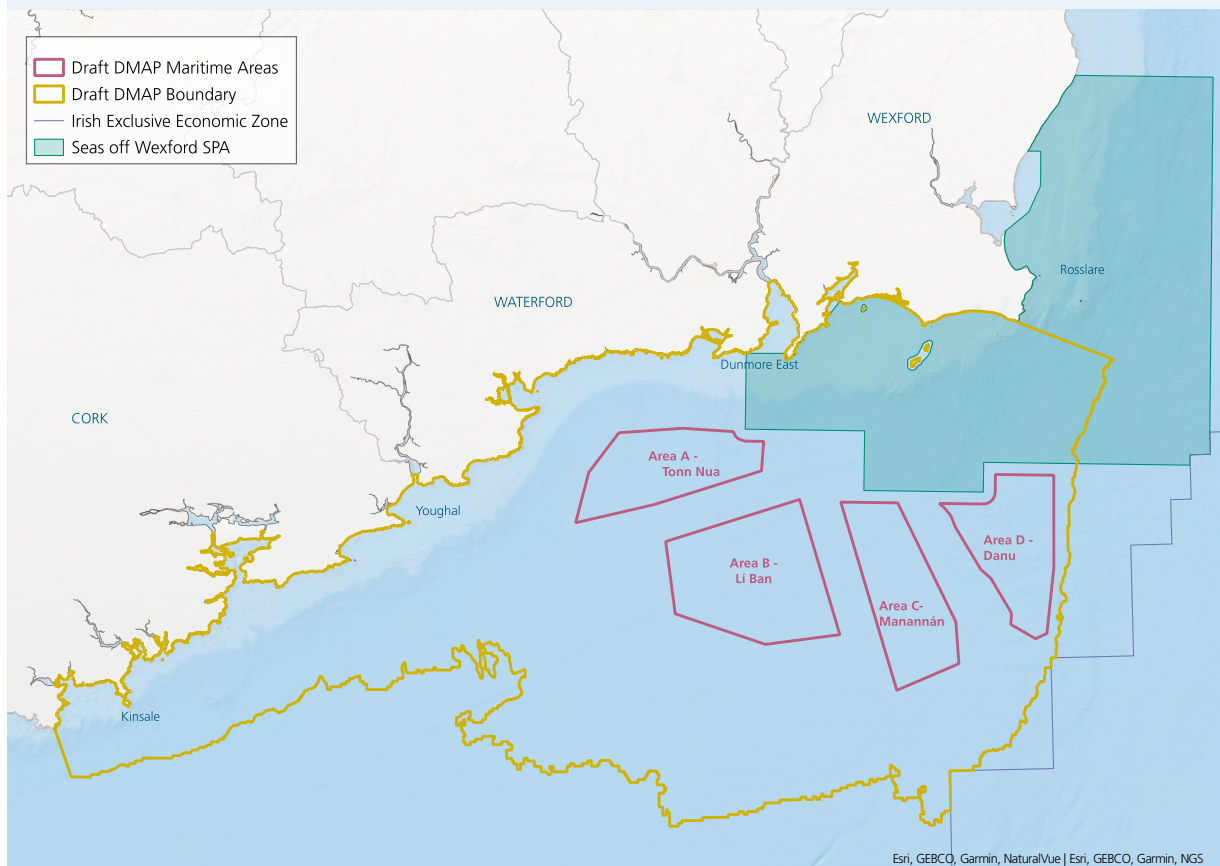
The views of the public are being sought through public consultation processes, for example on the South Coast Designated Maritime Area Plan (DMAP) proposal, published in May 2024.⁶ This proposal represents the first time the DMAP forward planning process, set out in the Maritime Planning Act (2021), has been applied in Ireland and is focused on identifying the geographical areas for future offshore renewable energy development (Figure 9.12). A further ecological sensitivity analysis is being completed for the Celtic Sea in 2024 to align with the proposed South Coast Offshore Renewable Energy DMAP. This will ensure that protection of the marine environment is considered concurrently with the development of offshore renewables.

5 www.gov.ie/en/publication/e00ec-marine-protected-areas/ (accessed 2 May 2024).

6 [gov](http://gov.ie) – Public Consultation on the Draft South Coast Designated Maritime Area Plan for Offshore Renewable Energy (SC-DMAP) (www.gov.ie) (accessed 16 May 2024).



Figure 9.12 Geographical area of the proposed South Coast Designated Maritime Area Plan (DMAP)



Source: DECC, 2024

4. Responses

Ireland's MSFD Programme of Measures, led by the DHLGH, sets out Ireland's plan to maintain or achieve GES for our marine waters up to 2028. The Programme of Measures considered the assessment of Ireland's environmental status and the environmental targets outlined in Ireland's Marine Strategy Part 1 (DHLGH, 2020).

Among the actions set out in the programme are those to:

- develop and expand Ireland's MPAs to cover 30% of our marine area by 2030 (including planned enactment of the Marine Protected Areas Bill in 2024)
- develop nature-based solutions in coastal and marine systems to protect biodiversity, improve resilience to climate change and reduce the impact of pollution
- provide environmental guidance for offshore renewable energy

- develop an all-Ireland management strategy for non-indigenous species and invasive species in coastal and marine areas
- update guidance on reducing underwater noise pollution to protect marine mammals
- fully implement the Single Use Plastics Directive and Circular Economy Act as part of a wide range of actions aimed at reducing litter and plastics in our seas.

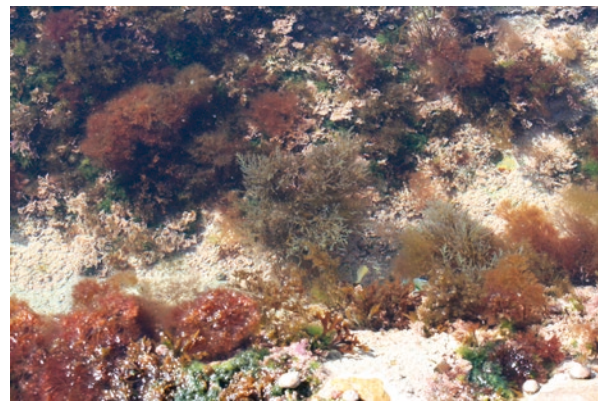
While the WFD Water Action Plan mentions the need for better integration of actions to protect shellfish waters and aquaculture, there are few clear measures specifically targeting marine waters. There is, however, an increase in the number of priority action areas that include transitional and coastal water bodies. Feedback from the public consultation process highlighted the failure of the draft plan to adequately address coastal pressures and the scarcity of measures to address coastal and transitional issues.



Measures implemented through the Water Action Plan will be the primary response to addressing the increasing nutrient enrichment issues in our estuarine waters. In particular, the agricultural measures (see Chapters 8 and 10) will help to reduce the inputs of nutrients into the marine environment. In addition, the catchment-based approach to managing water resources and dealing with water quality issues is well established in Ireland and should assist in addressing nutrient issues (DHLGH, 2024a).

The EU Nature Restoration Law (Regulation (EU) 2024/1991) will set legally binding targets to restore degraded ecosystems and prevent and reduce the impact of natural disasters. The law entered into force in August 2024 and will require all Member States to produce a national restoration plan within 2 years of adoption (NPWS, 2024).

In 2023, Ireland brought in the Sea Pollution (Ballast Water Management Convention) Regulations (S.I. No. 188/2023) to give effect to the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention). Under the regulations, all ships are now required to manage their ballast water and sediments to agreed standards. The regulations apply to all Irish ships and to foreign-flagged ships under port state control.



Rockpool containing *Cystoseria*

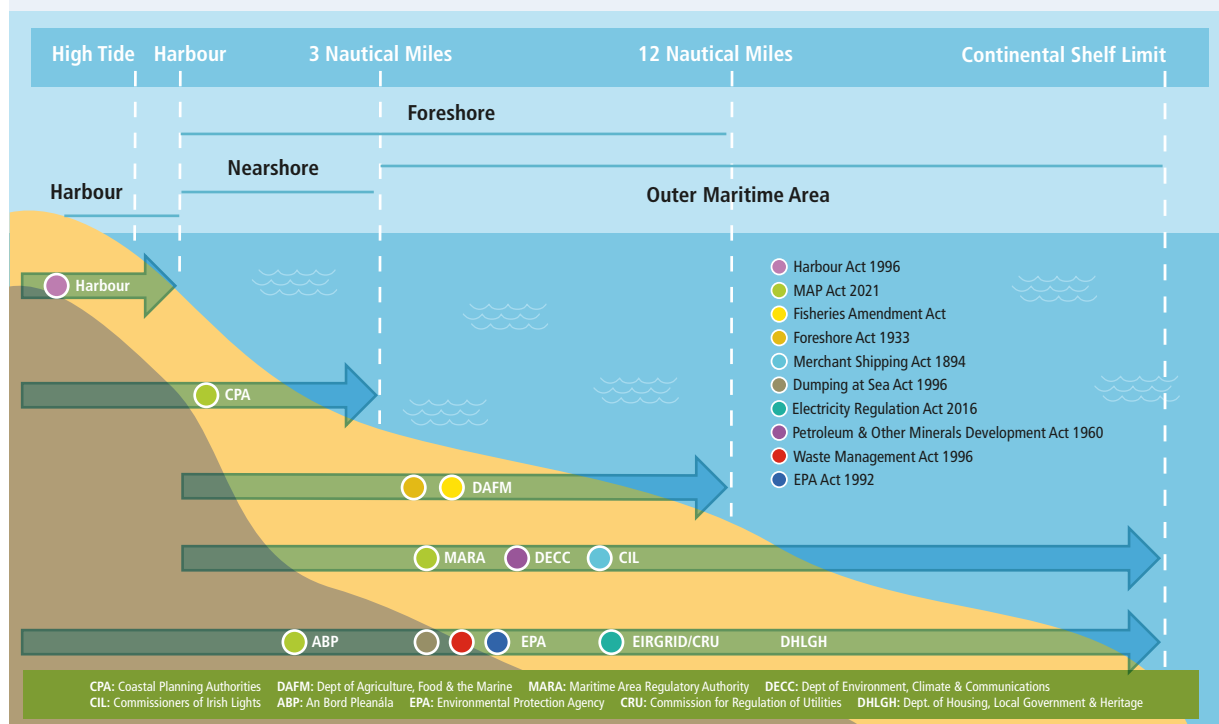
While the development of nature-based solutions has been tested to a limited degree in Ireland (e.g. Devaney and Perrin, 2015; Cott *et al.*, 2021; Farrell *et al.*, 2023), there is still much to be understood to ensure that the potential co-benefits in terms of increased biodiversity, reduced eutrophication and climate change mitigation are maximised. Work is ongoing at the OSPAR level to collate best practice examples from across the North-East Atlantic and see how different countries can work together to achieve the best outcomes (OSPAR, 2021b).



Spatial planning

The new Maritime Area Planning Act (S.I. No. 50/2021) established a planning system for Ireland's maritime area (Figure 9.13). This is underpinned by a statutory Marine Planning Policy Statement and guided by the National Marine Planning Framework to balance the sustainable use of marine space with the protection of marine ecosystems. Specific designations for activities under this, such as offshore wind energy, will then be guided by Designated Maritime Area Plans (DMAPs).

Figure 9.13 Marine planning system



The Maritime Area Regulatory Authority

MARA was established in July 2023 (DHLGH, 2023b). The establishment of MARA is part of the biggest reform of marine governance in Ireland in almost a century. It marked the transition to a new maritime consenting regime and established a development management regime from the high water mark to the outer limit of the state's continental shelf, administered by An Bord Pleanála, the coastal local authorities and MARA. This new distribution of powers will require building capacity in those organisations with less experience in coastal planning.

MARA is an independent regulatory body responsible for managing and regulating development and activity in Ireland's maritime area. MARA has responsibility for assessing applications for Maritime Area Consents (MACs), which will be required before projects in the maritime area, such as offshore wind, can apply for development consent. MACs confer a right to occupy the maritime area subject to any necessary development

consent. MARA is also responsible for granting maritime usage licences for certain activities in the maritime area (e.g. site investigations, dredging, installation of non-permanent pontoons). The MAC regime does not apply to some developments, including those involving navigation, fishing, aquaculture and petroleum exploration.

MARA's functions are set out in the Maritime Area Planning Act 2021 as follows:

- assessing MAC applications for the maritime area
- assessing maritime usage licence applications for specified non-permanent activities
- checking compliance with and enforcement of MACs, licences and offshore development consents granted by An Bord Pleanála
- investigations and prosecutions
- administration of the existing foreshore consent portfolio
- fostering and promoting cooperation between regulators of the maritime area.



As one of the largest potential new uses of the maritime area, the development of offshore wind needs to be carefully considered across all organisations to clearly define how protection and development are to be managed and what appropriate development is, particularly in relation to protected areas.

Marine fisheries

The Common Fisheries Policy governs the fishing sector in Ireland. Irish fisheries data are combined with those from other countries through the International Council for the Exploration of the Sea to provide scientific assessments and advice establishing total allowable catches for fish stocks. A number of historical and recent measures have been developed under this policy to ensure that fishing and aquaculture are environmentally, economically and socially sustainable. Since 2014, the reform of the Common Fisheries Policy has led to the phased introduction of landing obligations for species subject to catch limits. Measures in place for Irish fisheries include a range of area closures, restrictions and technical measures to conserve stocks and the prohibition of bottom trawling in designated coral protection areas and in deep waters (BIM, 2023c).⁷ Common Fisheries Policy, national and other measures are included in Ireland's MSFD Programmes of Measures (DHLGH 2022).

In 2023, as part of a 'fisheries and ocean' package, the European Commission published an EU action plan to protect and restore marine ecosystems for sustainable and resilient fisheries (EC, 2023). This aimed to ensure sustainable fishing practices so that fish stocks are fished at a sustainable level and the impacts of fishing on the seabed and on sensitive species are reduced. Actions include phasing out mobile bottom fishing gear in MPAs by 2030, increasing gear selectivity, supporting a just transition for fishers whose livelihoods are impacted by the measures, and strengthening knowledge, research, enforcement, governance and stakeholder involvement.

Aquaculture

The European Commission (EC, 2021) set out its strategy to develop the potential of aquaculture as a source of food in a sustainable manner in line with the European Green Deal. The National Strategic Plan for Sustainable Aquaculture Development 2030 was issued in October 2023 (DAFM, 2023). This aims to sustainably grow the aquaculture sector while ensuring the environmental protection of marine ecosystems and minimising the sector's carbon footprint. The growth of the aquaculture sector must be considered in relation to its impact on marine environmental status under the WFD and MSFD and also on the qualifying interests of protected sites under the Nature Directives.

Climate mitigation and adaptation

The national Climate Action Plan 2024 (DECC, 2023) highlights ambitious marine-relevant climate change mitigation and adaptation targets. The Maritime Area Planning Act 2021 provides for a new national approach to marine planning. Measures developed under these policies need to be considered in the wider ecological context to ensure that maximum co-benefits can be achieved. For example, nature-based solutions can play a role in mitigation and adaptation planning, with the added co-benefits of protecting and restoring degraded ecosystems. Under the MSFD Programme of Measures, nature-based solutions have been identified as key to achieving MSFD targets. The role of coastal Irish ecosystems as a carbon sink, in particular seagrass beds and saltmarshes, is an area of active research^{8,9} to better understand how conservation, management and restoration of these ecosystems could protect carbon stores and contribute to mitigation and adaptation measures. But they also need to be considered for their potential to mitigate nutrient enrichment and to enhance biodiversity. The development of a network of MPAs in Ireland's marine areas will include provisions for the protection of ecosystem services such as those provided by 'blue carbon' habitats and climate-resilient features both in coastal areas and offshore.

⁷ Below 400 m in other vulnerable marine ecosystem areas and below 800 m in deeper waters.

⁸ Examples of three blue carbon projects led by University College Dublin: Blue Carbon Group (www.ucd.ie/bluecarbon/home/), BlueC (www.bluec.ie) and QUEST (Research Climate Data Table Dev | Environmental Protection Agency (epa.ie)).

⁹ cordis.europa.eu/project/id/101093865 (accessed 2 May 2024).



Projected increases in sea level and storm surges will result in an increased frequency of coastal flooding and erosion, with significant impacts on coastal settlements, communities and infrastructure. Coastal adaptation responses can include protection (e.g. hard engineering or nature-based solutions), accommodation (adapting to the risks) or managed retreat (Farrell *et al.*, 2023; EPA, 2023b). The Climate Change Sectoral Adaptation Plan for Flood Risk Management 2019-2024 (OPW, 2019), prepared under the National Adaptation Framework, sets out actions to ensure that the potential impacts of climate change on flooding and flood risk are effectively managed.

The establishment by government of an interdepartmental group to consider the scoping of a National Coastal Change Management Strategy recognised that there are current and urgent coastal change issues to be addressed in parallel to the implementation of a medium- to long-term framework. This group was tasked with scoping out an approach for the development of an integrated, whole-of-government strategy for managing our changing coast. Its report included 15 recommendations for enhancing governance and capacity building, growing the evidence base and developing management options (DHLGH and OPW, 2023).

The Biodiversity Climate Change Sectoral Adaptation Plan (DCHG, 2019) and the National Biodiversity Action Plan (NPWS, 2024) also include actions relevant to the effects of climate change on the marine environment. Protection of designated areas and species is a key adaptation measure that addresses biodiversity loss and facilitates building ecosystem resilience to climate change and ocean acidification.

Good data and scientific information are critical to adaptation and planning. Sustained observations of oceanographic, biogeochemical and biological essential ocean variables (Nolan *et al.*, 2021), in line with international best practice for climate monitoring, are essential to support policy development and are included in the Climate Action Plan. The deployment of new infrastructure and participation in international networks and programmes (such as GO-SHIP, Argo and ICOS) have enhanced national observing capabilities (Cámaro García and Dwyer, 2021; Nolan *et al.*, 2021, 2023).

In recognition of its importance, the OSPAR Commission features climate change and ocean acidification as one of four themes in its North-East Atlantic Environment Strategy 2030 (OSPAR, 2021a), with agreed strategic objectives for monitoring and assessment, awareness, mitigation and adaptation.



Marine litter and plastics

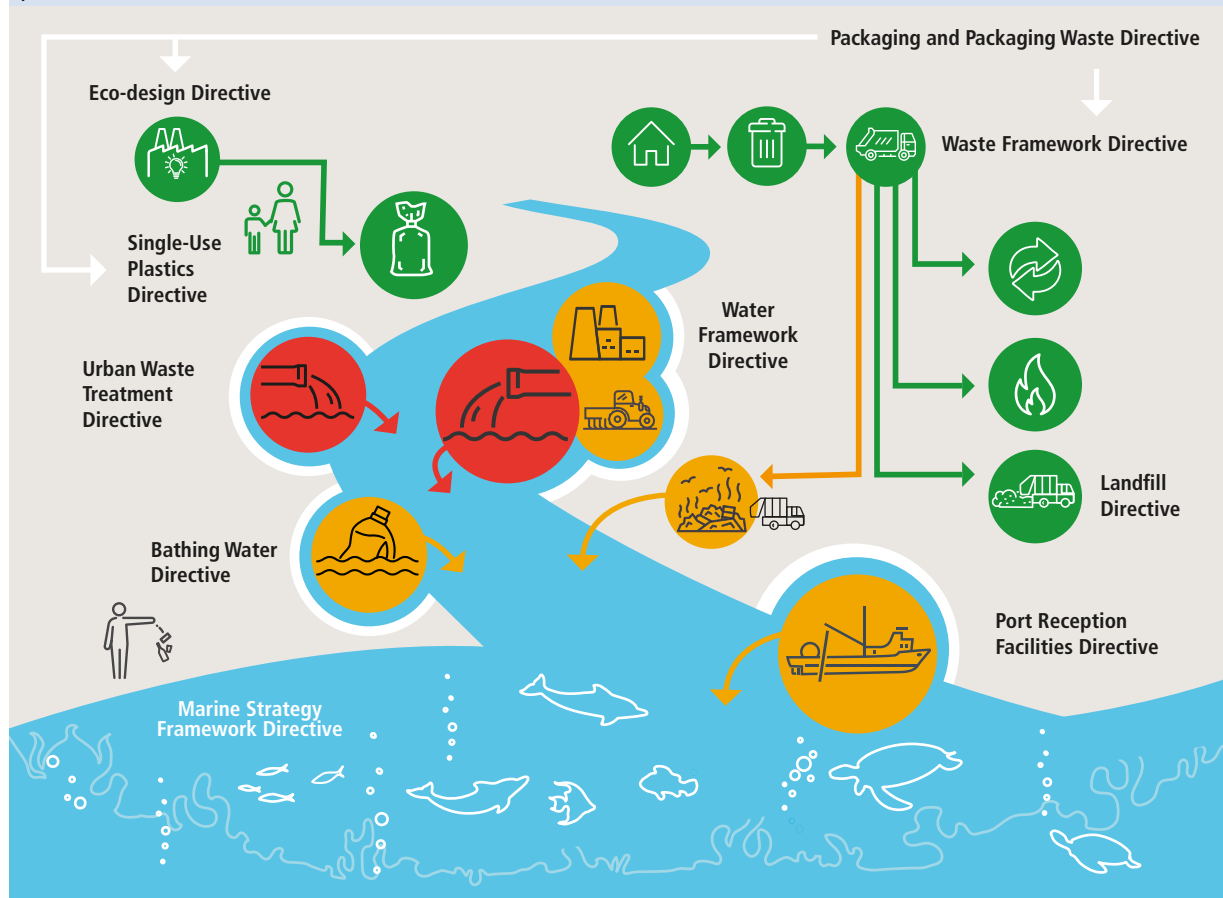
Litter remains abundant across Atlantic beaches (ETC/ICM, 2023; Lacroix *et al.*, 2022). Beach litter is defined as any persistent, manufactured or processed solid material discarded, disposed of, or abandoned in the marine and coastal environment and encountered on beaches.

Single-use plastics and maritime-related plastic litter, such as those from fishing and aquaculture activities, are the most common components of beach litter. Four beaches around the coast of Ireland were monitored over the same transect four times a year using the common OSPAR methodology. The median value was below the threshold value of 20 items per 100 m at two of the four beaches surveyed over the period 2016-2021. The beaches at Silver Strand, Co. Mayo and Carnsore, Co. Wexford fell below the threshold value at 16 and 19 items per 100 m, respectively. Long Strand, Co. Cork and Clogherhead, Co. Louth exceeded the threshold value with 182 items and 90 items per 100 m, respectively.

For comparison, the median total count in the OSPAR North-East Atlantic Area over the period 2018-2020 was 252 items per 100 m, so levels of beach litter in Ireland are below those in other countries in northern Europe (Lacroix *et al.*, 2022).

To strive towards achieving low litter levels on all beaches, multiple legislative measures are in place to control litter entering the marine environment (ETC/ICM, 2023) (Figure 9.14). In Ireland, legislative changes include a ban on microbeads, introduced at the end of 2019, and the launch of a deposit return scheme focusing on single-use plastics and other drinks containers in 2024. Bord lascaigh Mhara operates the Fishing for Litter¹⁰ initiative to encourage fishers to take ashore the litter they encounter at sea while fishing. However, more action is needed to further reduce the prevalence of marine litter along Irish coasts.

Figure 9.14 European directives relevant to marine litter and domains they target across the life cycle of plastics and waste



Source: Adapted from Deltares graphic in ETC/ICM, 2023

10 fishingforlitter.org/ireland (accessed 2 May 2024).



Research

A range of government departments and agencies have a role in the promotion and funding of marine research in Ireland, including Science Foundation Ireland, the Irish Research Council,¹¹ the EPA and the Geological Survey of Ireland. The Marine Research Funders' Forum¹² was established in 2018 under the National Marine Research and Innovation Strategy 2017-2021. The forum brings together state funding organisations with the aim of enhancing coordination in marine-related research funding. More than 600 marine research projects were funded nationally between 2017 and 2022.

EPA research programme projects include the following.

- the carbon sequestration potential of the marine environment (e.g. Investigating Ireland's Blue Carbon Potential through a Scientific, Socio-economic and Legislative Approach (BlueC) – quantification, characterisation, source and fate of past and present carbon storage in coastal offshore sediments for effective marine management)
- developments in remote sensing (Artificial Intelligence-powered Forecast for Harmful Algal Blooms – an exploitation of remote sensing CMEMS products for monitoring of transitional and coastal waters).

5. Conclusions

Overall, while our wider offshore marine areas are generally healthy and productive, there are some clear issues and increasing pressures at play. The draft MSFD assessment has highlighted that biodiversity is a key concern in the wider marine environment. Climate change impacts are already being seen in our marine waters, with changes in sea levels and temperatures and ocean acidification already evident. These impacts can act in combination with other pressures to increase the potential for further degradation of delicate ecological communities.

Fishing remains a significant pressure in our oceans, with less than 20% of the fish stocks assessed being sustainably fished. This can have knock-on effects on our wider food webs and may contribute to Ireland not meeting its obligations under the MSFD.

Our nearshore and estuarine waters are showing clear signs of nutrient enrichment, with 64% of our estuaries at moderate or worse status. While this has not yet affected our wider coastal and marine areas, the continued pressure is likely to cause effects in these areas in time if measures identified under the WFD and MSFD are not fully implemented to address it.

The coherence between these policies needs to be better aligned to ensure that the sustainable use of Ireland's maritime area occurs without adverse impacts on the environment. Recent policy measures such as those related to the development of offshore renewable energy and a target to protect 30% of our marine waters need to be properly and quickly aligned. While developments in spatial planning are progressing, the introduction of MPA legislation has been repeatedly delayed.

11 The Research and Innovation Act, signed into law in June 2024, provides for the establishment of Taighde Éireann and the amalgamation of Science Foundation Ireland and the Irish Research Council: www.oireachtas.ie/en/bills/bill/2024/1/ (accessed 2 May 2024).

12 www.marine.ie/site-area/research-funding/national-marine-research-strategy/marine-research-funders'-forum (accessed 2 May 2024).



Key chapter messages

- 1.** Our wider marine environment is generally clean and healthy, but legislation to maintain this needs to be enforced more rigorously and new priorities addressed more quickly. For example, the delayed marine protected areas legislation is an essential part of the marine spatial planning approach that will ensure that marine developments do not occur at the expense of the wider marine environment.
- 2.** Key pressures are still causing impacts on the biodiversity and productivity of marine ecosystems. Fishing at unsustainable levels is impacting both habitats and the food chain. Nearshore nutrient enrichment has the potential to affect coastal amenity. Measures to combat these issues need to be implemented and enforced, as current trends are indicating that environmental status is not moving in the right direction.
- 3.** There have been many recent changes in marine policy. Policy coherence and coordination needs to be improved to avoid damaging our marine environment and to maximise the benefits of protecting it.





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