

How does
shipping
fit into NDCs?



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1 Introduction

1.1 Background and purpose of the report

Shipping is a global industry of immense scale and strategic importance, facilitating the movement of more than 80% of world goods and enabling the economic interdependence of regions and states. Its value chain spans multiple sectors and jurisdictions, making it both highly integrated and operationally dispersed across the globe. While shipping enables economic growth, energy security, and access to critical goods, it also exerts significant pressure on the climate, as maritime transport accounts for approximately 2-3% of the annual global emissions, the marine environment, and ocean biodiversity.^{1 2}

Because ships routinely cross national borders, the sector has traditionally been governed through international regulation, particularly under the International Maritime Organization (IMO). However, while this global governance framework is essential for ensuring uniform safety and environmental standards, it has also meant that shipping has often sat outside national climate policymaking. At the same time, the sector contributes significantly to greenhouse gas (GHG) emissions and exerts wide-ranging pressures on the marine environment and biodiversity, including underwater noise, pollution, and physical disturbance of marine habitats. These impacts occur within national waters as well as on the high seas, and they interact with regional ecosystems in ways that global regulation alone cannot fully address. For this reason, there is growing recognition that states have both the mandate and the opportunity to incorporate shipping into their Nationally Determined Contributions (NDCs). Doing so allows countries to align domestic climate ambitions with regional environmental priorities, strengthen accountability, and accelerate the decarbonisation of a sector that is globally mobile but locally impactful.³

1.1.1 Purpose of the report

This report was commissioned by the VELUX Foundation, which seeks to explore current national ambitions and the potential for integrating shipping into NDCs in alignment with IMO's Decarbonisation Strategy. The VELUX Foundation aims to assess how shipping can be incorporated into NDCs in a manner that also takes due account of the marine environment and ocean biodiversity. This study thus aims to map existing knowledge and identify opportunities for integrating sustainable shipping into NDCs and does so by emphasising overarching considerations for enhancing integration. It will also identify legal and research-related knowledge gaps regarding the environmental and biodiversity impacts of shipping and contribute to a dialogue that can inform policymakers and support target-setting.

While the global shipping industry and its broader value chain place significant emphasis on decarbonisation when setting climate mitigation targets, considerations related to the marine environment and ocean biodiversity are often overlooked.⁴ This report seeks to address this gap by examining how shipping can be integrated into NDCs in ways that account for both marine environmental conditions and biodiversity.

¹ Digital MiljøAdministration (n.d.)

² Sustainable Shipping Initiative (2025)

³ Transport & Environment (2025)

⁴ Wisz et al. (2025)

Although climate, the marine environment, and ocean biodiversity are frequently treated as distinct policy and research domains, they form an inherently interconnected system in which changes in one domain inevitably influence the others. These areas are conceptually separated because they concern different phenomena and rely on different types of data and analytical tools. Climate refers to large-scale patterns such as temperature, ocean circulation, and GHG concentrations.⁵ The *marine environment* encompasses physical and chemical ocean conditions, including water quality, oxygen levels, nutrient loads, pollution, acidity, and salinity.⁶ *Ocean biodiversity* concerns the variety of life in marine ecosystems, including species, habitats, ecosystems, and genetic diversity.⁷

Despite these conceptual distinctions, climate, the marine environment, and ocean biodiversity function as a single ecological and biophysical system. Climate shapes marine environmental conditions, the marine environment regulates biodiversity, and biodiversity in turn influences both climate processes and environmental balance. This interconnectedness underscores the importance of recognising the relevance of the marine environment and biodiversity when addressing emissions reductions at sea and advancing climate action.

1.1.2 Reading guide

The report comprises three sections that cover the different phases of the study. The first section introduced the study and its methodology (which is elaborated in further detail in Appendix 1) and delimitation of the report's focus. The second section presents the findings from the analysis of the environmental governance framework of shipping in the North Sea region conducted through a combination of extensive desk research and the interview study. The third section discusses how and to what extent shipping is currently integrated into NDCs and explores how it can be more effectively incorporated into NDCs in the future. This section is also based on findings from desk research and the interview study.

1.2 Methodology

The project's data collection involves a knowledge assessment combining desk research and seven expert interviews, aimed at mapping existing knowledge and identifying opportunities for better integration of shipping into NDCs. Desk research provides a broad foundation, examining how and to what extent shipping is currently reflected in NDCs, as well as the national, regional, and global political frameworks governing the sector.

Expert interviews, conducted as a complement to the desk research, capture perspectives from various stakeholders across the shipping value chain. These interviews aim to deepen understanding of the motivations, needs, and attitudes of different sectors, thereby informing a realistic and coherent approach to integrating shipping into NDCs (see Appendix 1 for more information).

Throughout the data collection process, Ramboll involved the Velux Foundation. Their role was to review and prioritise the findings in accordance with the project's framework and scope, ensuring that the project remains focused and aligned with its objectives.

⁵ WMO (2018)

⁶ National Geographic Society (n.d.)

⁷ National Geographic Society (2024)

1.3 Delimitation of the report's focus

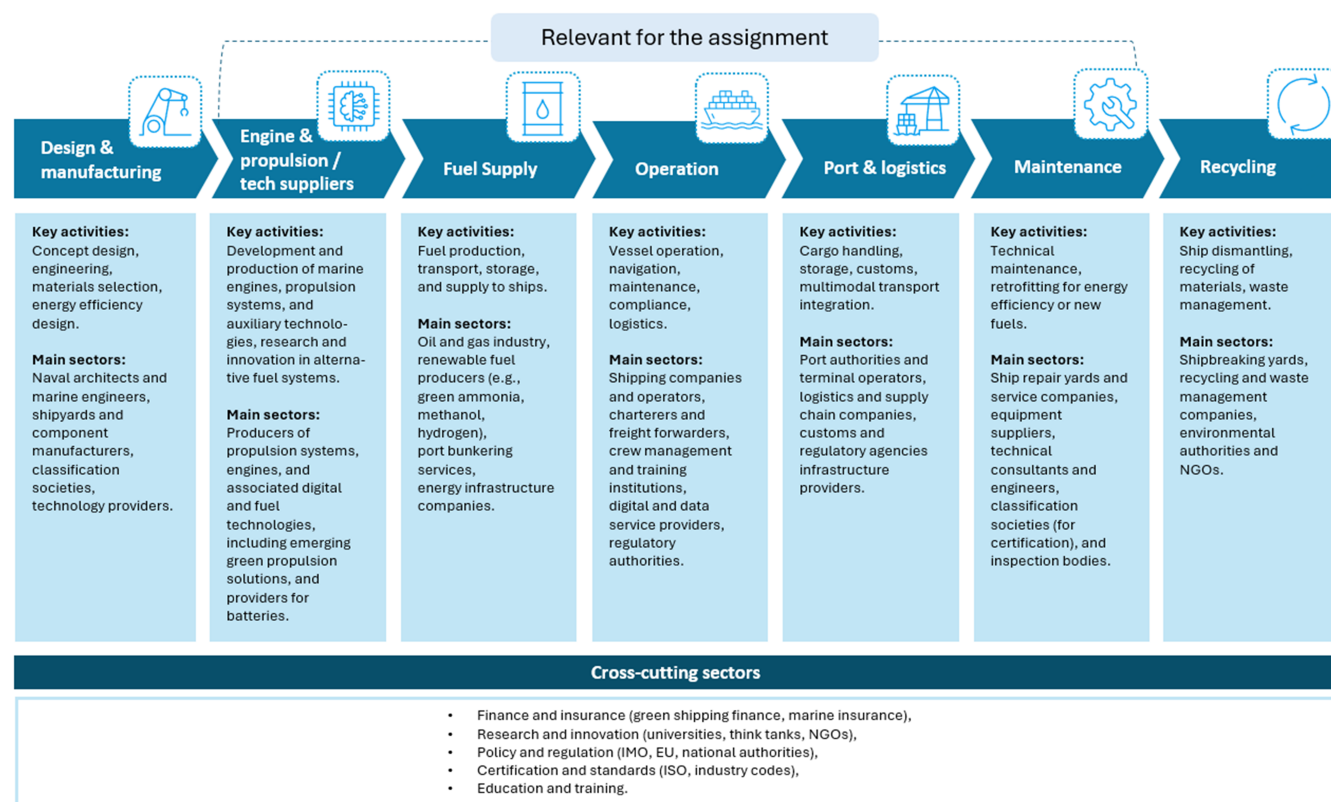
Figure 1.1 below shows an illustration of the shipping value chain which is included here for several important reasons.

First, it provides a structured understanding of the shipping sector's complexity by mapping the different streams and actors involved in maritime activities. It helps clarify that shipping is a network of interlinked processes that create value in different aspects, and each can contribute differently to GHG emissions.

Second, the value chain framework helps delineate which parts of the shipping sector are most relevant within the geographical focus of the study (the North Sea region). By situating the analysis within this structure, it becomes clearer which value chain segments are actively represented in the North Sea context (engine and propulsion/technology innovation, fuel supply, vessel operation, port activities, and maintenance) and which are primarily located elsewhere (such as large-scale shipbuilding or dismantling primarily located in South Asia).

Finally, using the value chain perspective enables a more targeted discussion of where and how climate action can be integrated into NDCs. It supports the identification of leverage points for emission reductions, technological innovation, and policy coordination across the relevant stages of maritime activity. In this way, the value chain serves as both a conceptual map and analytical tool linking regional realities in the North Sea to the broader goal of aligning global shipping with the Paris Agreement.

Two parameters – key activities and main sectors – are presented under each link in the value chain. These parameters serve to highlight, for each link: 1) the main activities that are particularly prominent and 2) the sectors identified as the most dominant or evident.

Figure 1.1. Illustration of shipping value chain

1.3.1 Geographical delimitation to the North Sea

The focus of this study is delimited to the North Sea and its surrounding region. This geographical focus has been chosen for several reasons, as summarized in Table 1.1. By narrowing the scope to the North Sea, the analysis also confines itself to those segments of the shipping value chain that are most directly relevant and active within this regional context.

At the same time, it is important to acknowledge that the shipping sector is inherently global in nature. Maritime activities and emissions are deeply interconnected across oceans and trade routes. Consequently, developments and policy measures in the North Sea are likely to have spillover effects, both economic and environmental, on other regions worldwide. Nevertheless, concentrating on the North Sea allows for a more in-depth and context-specific examination of how shipping can be incorporated into NDCs, while still maintaining relevance to broader global decarbonisation efforts.

The North Sea region can be defined in different ways depending on the context (e.g., geography, maritime boundaries, or cooperation frameworks). Generally, it includes seven coastal states that border the North Sea, and some nearby regions with strong economic, environmental, and governance ties. Thus, this project distinguishes

between two types of relevant countries:

- Countries with direct coastal access (the core region): Norway, Denmark, Germany, Netherlands, Belgium, France, United Kingdom
- Countries in the extended/cooperative region with maritime, ecological, or governance ties to the core region: Sweden, Ireland, The Faroe Islands

The report focuses on the North Sea region for several reasons. Below is an overview of parameters that especially highlight the relevance of the North Sea region, with emphasis on environmental, analytical, political, and practical considerations:

Table 1.1. Overview of the delimitation of the report's geographical focus across relevant parameters

Relevance parameter	Description of relevance
High concentration of shipping activity	The North Sea is one of the busiest maritime areas in the world, with dense cargo, ferry, and offshore traffic connecting major ports such as Rotterdam, Hamburg, Antwerp, and Bergen. This intensity makes it a high-impact testbed for assessing the inclusion of shipping in NDCs. Focusing on the North Sea allows for measurable, region-specific outcomes rather than diffuse global trends.
Shared regional commitments and governance frameworks	North Sea countries already cooperate through regional frameworks such as: • The North Sea Commission (under the Conference of Peripheral Maritime Regions), • The OSPAR Convention (for protection of the marine environment), • The EU's Green Deal and Fit for 55 package, • The IMO's regional implementation networks. These existing structures create a strong institutional foundation for regional coordination on maritime emissions and can act as building blocks for NDC integration.
Leading role in maritime decarbonisation	North Sea states are global frontrunners in maritime innovation and green shipping: • Denmark and Norway are leaders in green fuels and zero-emission vessels, • The Netherlands and Belgium invest heavily in hydrogen, methanol, and port electrification, • The UK focuses on offshore wind–shipping synergies. Concentrating on this region highlights feasible pathways and transferable policy models for integrating shipping into NDCs.
Strategic energy and infrastructure nexus	The North Sea region is rapidly transforming into a low-carbon energy hub with extensive offshore wind farms, carbon capture and storage (CCS) projects, and hydrogen infrastructure. Shipping interacts directly with these developments (e.g., transporting components, servicing offshore assets, using renewable fuels produced nearby). This provides a unique opportunity to study shipping within a broader decarbonisation ecosystem.

1.3.2 What is excluded by focusing on the North Sea?

By delimiting the focus of this assignment to the North Sea region, several parameters and aspects of the global shipping sector are intentionally excluded from the analysis. The study does not directly address shipbuilding, production, or end-of-life processes such as dismantling and recycling, which predominantly take place in regions outside Northern Europe. Likewise, deep-sea shipping routes that do not transit the North Sea, as well as coastal

or inland waterway transport in other parts of the world, fall beyond the scope. The analysis is further limited to the operational phase of shipping within and around the North Sea, particularly where it intersects with regional climate policy, marine governance, and energy infrastructure. Broader geopolitical, trade, or economic dimensions of global maritime transport are therefore not covered in detail. This delimitation enables a more targeted and coherent assessment of how shipping activities within the North Sea basin can be integrated into NDCs and regional decarbonisation strategies. Nevertheless, the findings of this project extend beyond the North Sea and its surrounding regions, offering transferable lessons and insights that may be applicable in various contexts globally.

The lessons drawn from this region – particularly regarding cross-border coordination, data transparency, and integration of maritime emissions into national climate frameworks – are highly transferable to other maritime contexts. The North Sea's experiences can inform global best practices for aligning shipping with the Paris Agreement, providing both institutional and technical models for countries seeking to decarbonise their maritime sectors.

1.4 Conclusions

The following synthesises the report's insights on how shipping can be integrated into NDCs.

1. The North Sea as a relevant context for integrating shipping into NDCs

Throughout the report, the North Sea serves as a concrete context in which the challenges and opportunities of integrating shipping into NDCs become particularly visible. The region is characterised by high traffic intensity, multiple coastal states and overlapping uses of marine space, including shipping, offshore energy, fisheries and nature protection. These conditions amplify governance complexity and environmental pressures, while also highlighting the need for coordinated approaches that link national climate commitments with regional and international frameworks. At the same time, the North Sea offers a strong potential as a practical testing ground for NDC-based approaches, as existing cooperation structures, advanced port infrastructure and data availability provide a foundation for piloting integrated measures.

2. Recognising shipping as an integral part of NDCs

Shipping has long existed outside national climate policymaking due to its global nature and the dominance of international regulation. The findings of this report show that this separation no longer reflects the realities of the sector or its environmental footprint. As shipping interacts directly with national waters, coastal ecosystems and domestic energy systems, countries now have both the opportunity and the responsibility to incorporate maritime activities into their climate strategies. Integrating shipping into NDCs therefore strengthens national ownership of climate action and aligns global mobility with domestic environmental objectives.

3. Understanding the interconnectedness of climate, marine environment, and biodiversity

The analysis reinforces that climate, marine environmental conditions and biodiversity form a single, interdependent system. Measures aimed at reducing maritime emissions inevitably influence underwater noise, water quality, and broader ecological resilience. Conversely, healthy marine ecosystems contribute to climate mitigation and adaptation. This systemic relationship highlights why climate actions in the shipping sector must be viewed not

only through a decarbonisation lens but as part of a wider effort to maintain ocean health.

4. Clarifying roles across governance levels

The study illustrates how global, regional and national frameworks governing the North Sea region each provide essential, but partial, tools for addressing the environmental impacts of shipping. Global standards ensure uniformity, regional regimes add ambition and ecological focus, and national instruments translate commitments into concrete implementation in the North Sea countries respectively. Understanding these complementary roles is key to identifying where North Sea countries can meaningfully strengthen their NDCs and their focus on shipping without duplicating existing processes. The multi-layered architecture therefore creates a structured entry point for embedding shipping within national climate commitments.

5. Structural barriers shape the space for integration of shipping in NDCs

The report identifies several systemic barriers that influence how and how quickly shipping can be integrated into NDCs. These include the division of responsibilities between national climate strategies and global regulation, economic and operational constraints in the sector, and gaps in data and institutional coordination. These structural factors do not prevent integration, but they shape the practical opportunities and highlight the need for clear governance links and coherent policy signals.

6. Recognising emerging potentials for integration of shipping in NDCs

Across research and interviews, there is growing momentum toward including shipping more explicitly in national climate strategies in the North Sea region. Existing tools, such as marine spatial planning, port efficiency initiatives, digital voyage optimisation and biodiversity-focused routing, illustrate how climate and ocean objectives can be addressed simultaneously. These emerging potentials show that integrating shipping into NDCs can support both decarbonisation and healthier marine ecosystems in the North Sea.

7. A foundation for future work and knowledge development

The report also identifies areas where further knowledge and coordination would support stronger integration of shipping into North Sea countries' NDCs. These include improving data on maritime environmental impacts, strengthening links between science and policy, and deepening cooperation across governance levels. While these gaps remain, they also highlight the potential for future research, regulatory alignment and stakeholder engagement. The findings therefore provide a foundation for continued work that can inform both national implementation and international dialogue.

2 Environmental governance of shipping in the North Sea

This section introduces and analyses three layers of the governance framework regulating shipping, with particular attention to how these layers overlap and diverge in relation to the marine environment and marine biodiversity. The findings presented below synthesise the most pertinent insights from the research and interview study concerning environmental regulation in the shipping sector.

This section is introduced here to outline the regulatory framework governing shipping at the various levels within

which national states operate. Understanding this framework is essential for assessing the conditions under which states set and implement national environmental targets, as well as the ways in which these frameworks both enable and constrain their efforts. Environmental regulation of shipping operates through a three-tier architecture:

1. Global rules set by the IMO
2. Regional frameworks, with this report focusing particularly on those of the European Union (EU) and Oslo-Paris Convention (OSPAR), as they govern the North Sea subregion that forms the core of the analysis
3. National implementation via climate and marine strategies

In principle, this architecture creates a governance chain in which universal norms are translated into regional instruments and domestic measures. In practice, the layers both overlap and complement one another: uniformity and market certainty stem from global standards, but these remain narrowly climate-focused, while higher ambition and ecological specificity tend to arise regionally and nationally where these matters are more meaningfully addressed.

Global rules ensure minimum global standards and market stability. At the global level, especially climate regulations are mandatory and measurable, including the EEXI, CII, global GHG intensity standards, the Data Collection System (DCS), with uniform MRV and enforcement mechanisms.⁸ Regional frameworks, particularly those of the European Union and OSPAR, introduce more stringent climate and environmental requirements, but do so unevenly and sometimes in parallel rather than in an integrated manner. According to interviews, national authorities vary in ambition, capacity, and timing, producing regulatory heterogeneity. These structural dynamics result in broad policy coverage but also generate coordination costs, fragmented mandates, and persistent silos between climate decarbonisation, biodiversity protection, and marine ecosystem management.

2.1 Global level: The IMO as standard-setter

At the global tier, the IMO acts as the primary standard setter for environmental regulation of shipping. Its authority lies not in rapid regulatory expansion but in offering uniform methodological and technical baselines such as life-cycle assessment guidelines and greenhouse-gas intensity metrics that ensure consistency across an international fleet. IMO's Marine Environment Protection Committee (MEPC) is the technical body that develops and enforces environmental regulations. Under IMO, the MARPOL Convention (International Convention for the Prevention of Pollution from Ships) is the main legal instrument for preventing pollution from ships.

It is generally assessed in the interviews that IMO-level action is critical for design-related and technical standards that must remain globally harmonised (e.g., engines, fuels, pollution control). Ship specifications remain constant worldwide. In contrast, navigational measures, including speed limits, routing, or seasonal restrictions, can more feasibly be regulated at regional or local levels.

In 2023, the IMO adopted a GHG strategy that orients the sector towards net-zero by 2050 with interim checkpoints⁹, shifting international shipping from perceived laggard to comparatively advanced among hard-to-abate

⁸ IMO (n.d.-a)

⁹ IMO (n.d.-b)

industries. There remains a persistent asymmetry between climate policy and biodiversity regulation. Decarbonisation has advanced more rapidly than frameworks addressing broader marine impacts such as underwater noise, bio-fouling, and light pollution.

According to interviews, this reflects structural characteristics of the maritime sector, where operational efficiency, cost control, and narrow margins strongly influence investment decisions. Environmental measures are rarely adopted voluntarily unless they support cost optimisation or can be implemented without adding significant financial burden, with more comprehensive action generally requiring firm regulatory drivers.

Progress on decarbonisation largely follows areas where regulatory frameworks provide clear direction and where compliance can be achieved without imposing disproportionate operational costs. Consequently, decarbonisation tends to progress, while broader ecosystem protection evolves at a slower pace. It is anticipated in the interviews that future alignment between IMO-led climate measures and ecosystem-based protection will partly depend on how emerging global instruments, including the Agreement on Marine Biological Diversity of Areas Beyond National Jurisdiction (BBNJ) and the Global Biodiversity Framework, are incorporated into maritime governance frameworks.

Table 2.1. Primary policy levers being utilised at the global level of governance for environmental regulation

Category	Policy lever
Emissions standards/climate and decarbonisation	• MARPOL Annex VI • IMO GHG Strategy (2023) • Carbon pricing/market-based measures • Ship design and efficiency
Pollution prevention/air and water pollution	• MARPOL Annex I–V
Marine environment and biodiversity protection	• Ballast Water Management Convention • Bio-fouling guidelines • Underwater Noise Guidelines/URN Action Plan • Particularly Sensitive Sea Areas (PSSAs)
Marine litter, noise, and invasive species	• MARPOL Annex V • Ballast Water & Biofouling Conventions • Underwater Noise Guidelines
Monitoring, assessment, and knowledge	• IMO DCS
Cross-sector and spatial planning	• IMO can provide guidance on routing, PSSAs, and operational measures

The policy levers outlined above are primarily implemented through design-related, globally harmonised standards that regulate technical specifications for engines, fuel systems, pollution-control technologies, and other ship components. These standards are supported by uniform Monitoring, Reporting, and Verification (MRV) systems and by enforcement mechanisms carried out through flag and port states, which together help maintain minimum global requirements and promote market stability.

However, the regulatory scope at the global level remains heavily concentrated on climate-related objectives. Climate mitigation measures are mandatory for all states and are supported by clear, quantifiable indicators, such as the EEXI, CII, and DCS, all of which rely on consistent MRV and enforcement structures. In contrast, measures addressing the marine environment and biodiversity are largely voluntary or weakly enforced according to interviews. Examples include the non-mandatory bio-fouling management guidelines and advisory-level recommendations on underwater radiated noise, neither of which carry the same regulatory weight or compliance mechanisms as the climate-related measures.

2.1.1 Current situation at the IMO (in 2025)

The IMO remains the most legitimate venue for universal rules but faces mounting political pressure and the risk of stalemate on next-step decarbonisation milestones. The pressure to act has become increasingly evident in light of the outcomes of the extensive negotiations at the Marine Environment Protection Committee's 2nd Extraordinary Session (MEPC/ES.2) in October 2025. The session considered the formal adoption of the IMO Net-Zero Framework (NZF), which would amend MARPOL Annex VI to introduce both a global fuel standard – aimed at reducing fuel GHG intensity – and a global pricing mechanism for ship emissions. The Committee, however, did not reach consensus on adoption (57 Member States in favour of adjournment versus 49 against), and the session was consequently adjourned for one year. As a result, the draft NZF remains inactive, with deliberations extended into 2026. No legally binding global GHG pricing mechanism or fuel standard regulation has therefore come into force, leaving the historic potential of the NZF unresolved.¹⁰

The postponement reflects deep divisions among member states, particularly over the adoption procedure (some wanted “explicit acceptance” instead of tacit) and opposition from certain key countries.¹¹¹² The outcome introduces uncertainty on both the regional and national level for stakeholders (shipping companies, fuel producers, ports, policymakers): planned investments in low carbon fuels or new technologies may be delayed until regulatory clarity returns, which may push expected shipping decarbonisation beyond 2027.

According to interviews, some anticipate possible “coalitions of the willing”, clusters of states and industry actors advancing climate measures outside the IMO if progress stalls (a dynamic reminiscent of the WTO's impasse). Such pathways could speed decarbonisation but at the cost of fragmentation, compliance complexity, and higher transaction costs for globally trading firms.

2.2 Regional level: EU and OSPAR as complementary regimes

At the regional tier, the EU and OSPAR play distinct but complementary governance roles. The EU builds on IMO standards by translating global rules into binding regional law, while also going beyond IMO baselines where political agreement exists. The EU functions as the most influential regulatory engine for maritime decarbonisation in the North Sea region. It transforms IMO's global baselines into binding, market-driven instruments, not least through its emissions trading framework, fuel-intensity requirements, and integrated marine policy. The EU is

¹⁰ CIMAC (2025)

¹¹ Bureau Veritas (n.d.)

¹² UN Office at Geneva (2025)

widely perceived as more ambitious than the global framework and more capable of mobilising funding, enforcement, and sector-wide incentives.

OSPAR is the leading marine environment and biodiversity governance body for the North Sea region. OSPAR, by contrast, does not regulate climate mitigation but provides ecosystem-based coordination across EU and non-EU states. It aligns biodiversity protection, pollution reduction, monitoring, and marine spatial planning, ensuring ecological coherence in a region where regulatory responsibilities are otherwise fragmented.

Together, the EU and OSPAR create a two-pillar regional governance system: the EU drives decarbonisation and hard-law obligations, while OSPAR embeds scientific knowledge and ecological integration. Yet these regimes often operate in parallel rather than in a synchronised manner, contributing to siloed governance across climate and biodiversity domains.¹³

Table 2.2. Primary policy levers being utilised at the regional level of governance for environmental regulation

Category	Policy Lever
Emissions standards/climate and decarbonisation	• EU: EU ETS – Maritime (2024–2027); FuelEU Maritime (from 2025); European Green Deal/Fit for 55 • OSPAR: No climate-specific levers, focus on environmental pressures
Pollution prevention/air and water pollution	• EU: Water Framework Directive (WFD), SECAs • OSPAR: Regional Action Plans; eutrophication and contaminant reduction programmes
Marine environment and biodiversity protection	• EU: MSFD; Habitats & Birds Directives; Natura 2000 MPAs; EIA Directive • OSPAR: MPA network (including ABNJ); measures for threatened and declining species and habitats
Marine litter, noise, and invasive species	• EU: Indirect coverage via MSFD descriptors and WFD • OSPAR: Marine Litter Action Plan; noise and underwater sound initiatives; regional coordination on ballast water and invasive species
Monitoring, assessment, and knowledge	• EU: MSFD monitoring and reporting obligations • OSPAR: QSRs; common indicators and monitoring programmes; JAMP
Cross-sector and spatial planning	• EU: MSP Directive (spatial allocation and routing) • OSPAR: Regional MSP principles; cumulative impact frameworks (shipping, energy, fisheries, climate)

EU legislation builds on, and in some areas exceeds, the baseline established by the IMO by introducing binding regional obligations and dedicated financing mechanisms. At the same time, OSPAR plays a key role in ensuring ecological coherence across both EU and non-EU parts of the North-East Atlantic. Despite these complementary roles, the different regimes often operate in parallel rather than in an integrated manner, resulting in coordination gaps and a fragmented governance landscape.

Climate policy within these regimes generally progresses more rapidly than policies addressing the marine environment and biodiversity. This imbalance creates misalignment between decarbonisation initiatives and the

¹³ UNEP (2025)

ecological protection measures needed to safeguard marine ecosystems.

Because coordination across regulatory frameworks is limited, measures tend to be developed independently, for example, GHG reduction strategies are advanced separately from marine protected area (MPA) planning. This leads to policy silos and reduces opportunities for integrated, cross-cutting solutions that could address climate, environmental, and biodiversity challenges simultaneously.

2.3 National level: Implementation and policy instruments

North Sea states (EU members, United Kingdom, and Norway) operationalise global and regional frameworks through national climate laws, marine strategies, port-level rules (e.g., onshore power, waste reception, scrubber policies), and MPA management. While all North Sea states apply IMO frameworks, EU member states additionally implement EU directives, whereas non-EU states such as the UK and Norway pursue autonomous pathways while coordinating via OSPAR. According to interviews, the variation in ambition and timing across NDCs and sectoral plans introduces regulatory heterogeneity, with potential competitiveness effects and transaction costs for operators.

Table 2.3. Primary policy levers being utilised at the national level of governance for environmental regulation (examples)

Category	Policy lever
Emissions standards/climate and decarbonisation	- Public-private partnership to scale zero-emission fuels and vessels - Support for clean tech, innovation, and zero-emission ships - Shore-power subsidy for ports to reduce local emissions
Pollution prevention/air and water pollution	- Support for zero-emission shipping reducing NO_x and SO_x air pollutants - Green Award certification for ships that surpass environmental standards (lower-pollution vessels)
Marine environment and biodiversity protection	- National climate-shipping policy drives zero-emission fuels - Green Award scheme rewarding pioneer vessels with environmental certification
Marine litter, noise, and invasive species	- Supporting technologies that also reduce noise and discharges - Incentivising clean shipping through Green Award
Monitoring, assessment, and knowledge	- National climate fund investing in sustainable fuel infrastructure and monitoring approaches - Research on ship-based carbon capture, energy demand, shore-power systems
Cross-sector and spatial planning	National maritime-spatial planning integrating shipping, offshore wind, and environmental protection

As shown above, national authorities are responsible for implementing domestic regulations, issuing permits, enforcing compliance, and establishing targeted navigation measures, such as speed limits, routing schemes, or seasonal restrictions in ecologically sensitive areas. In doing so, they operationalise global and regional frameworks while also allowing for higher levels of ambition and more tailored ecological protection measures.

However, differences in ambition and timing across North Sea countries result in significant regulatory heterogeneity.

National climate and marine policies progress at varying rates: some states implement early zero-emission incentives or stringent biodiversity protections, while others adopt a more gradual approach. This divergence in the implementation of IMO rules, EU directives, and national protections leads to uneven regulatory requirements, varied ecological outcomes, and higher compliance and routing costs for shipping operators moving between jurisdictions.

2.4 The shipping industry: Innovation driver and feedback mechanism

Across all tiers of the regulatory system, the shipping industry together with maritime technology providers plays a central role in shaping how standards are developed and implemented. As the sector adopts new technologies, invests in compliant or future-proof vessels, and continuously generates operational data, it becomes an indispensable counterpart to regulators.

On the one hand, the industry operates as the primary implementer of both global and regional rules, translating policy targets into everyday operational practices. On the other hand, it acts as a driver of innovation by testing alternative fuels, developing advanced propulsion technologies, and experimenting with efficiency measures that make compliance pathways technically and economically feasible. At the same time, the data the industry supplies, ranging from fuel performance to emissions profiles, feeds back into the regulatory process and informs adjustments to standards and methodologies.

Through this combination of regulatory implementation, technological advancement, and knowledge co-production, the maritime sector effectively functions as a fourth tier in the broader governance architecture. It is here that regulatory ambition is converted into tangible environmental outcomes, as industry decisions and investments ultimately determine whether targets set at IMO, EU, and national levels can be realised in practice.

3 Integrating shipping in NDCs

This chapter presents the findings on how shipping is currently reflected in countries' NDCs and examines the extent to which both domestic and international shipping are included in national climate commitments. The chapter also draws on insights from the stakeholders to identify emerging trends and co-benefits related to marine biodiversity, while highlighting key barriers that continue to hinder stronger integration.

The chapter further discusses how shipping could be more effectively incorporated into future NDCs, emphasising the potential to align decarbonisation, ocean health, and biodiversity objectives. Through this lens, it considers how countries, financial actors, and civil society can play complementary roles in bridging the existing gap between global climate ambition and maritime governance.

3.1 What are NDCs?

NDCs are the central mechanism through which countries outline their individual climate action plans under the Paris Agreement, the legally binding international treaty on climate change adopted in 2015. Each NDC sets out

a country's targets for reducing greenhouse gas emissions, as well as measures for adapting to the impacts of climate change. While the content and level of ambition differ between countries, NDCs collectively form the foundation of global efforts to limit the rise in average global temperature to well below 2°C above pre-industrial levels, and preferably to 1.5°C.¹⁴

As part of the broader framework of the United Nations Framework Convention on Climate Change (UNFCCC), NDCs represent a shift from a top-down system of negotiated targets to a bottom-up approach, where each country defines and communicates its own contribution in line with its national circumstances and capabilities. This structure is designed to ensure both flexibility and inclusivity, while still demanding increasing ambition over time.¹⁵

Countries that are parties to the Paris Agreement are legally obliged to prepare, communicate, and maintain successive NDCs every five years. They are also expected to pursue domestic measures aimed at achieving the targets they set.¹⁶ To encourage accountability, the Agreement requires countries to report regularly on progress and participate in a global stocktake (GST), which assesses collective advancement toward the Agreement's long-term goals. In this way, NDCs are both a reflection of national priorities and a binding commitment to contribute to the shared global challenge of climate change.¹⁷

The first NDC updates were due in 2020 at COP26, but the conference took place a year later due to COVID-19. The NDCs to be submitted in 2025 (NDCs 3.0), are to be informed by the outcome of the first GST. NDCs 3.0 need to be progressive and more ambitious than current NDCs and are seen as a crucial element in putting the world on track with a global emission trajectory in line with the Paris Agreement's 1.5°C goal.¹⁸ As of now, a total of 34 parties have communicated new or updated NDCs since 25 September 2023.¹⁹

Beyond their role as formal submissions under the Paris Agreement, interviews highlighted the importance of understanding NDCs as process-oriented policy instruments rather than static political statements. In this perspective, NDCs can function as frameworks that structure national dialogue, prioritisation and implementation across sectors and governance levels. The NDC Guidance Tool developed for offshore wind illustrates how sector-specific guidance can support this approach by translating high-level climate commitments into concrete steps, stakeholder engagement processes and indicative policy measures.²⁰ Such toolkits can help countries move from ambition to action by clarifying roles, sequencing decisions and identifying entry points for investment and regulation. Applied more broadly, this process-oriented understanding suggests that NDCs can serve as signals not only of political intent, but also of implementation pathways and investment direction.

¹⁴ UNFCCC (n.d.-a)

¹⁵ UNFCCC (n.d.-b)

¹⁶ UNFCCC (n.d.-b)

¹⁷ UNFCCC (n.d.-c)

¹⁸ UNFCCC (n.d.-d)

¹⁹ UNFCCC (2024)

²⁰ Ocean Conservancy et al. (2024)

3.1.1 The Blue NDC Challenge

The Blue NDC Challenge – launched by France and Brazil – was a global call for all Parties to the Paris Agreement to integrate ocean-based climate solutions into their NDCs, due before COP30 in Brazil in November 2025, or their implementation plans. By joining, governments commit to accelerating ocean-based mitigation and adaptation actions that deliver benefits for climate, nature and people. Governments that take the Blue NDC Challenge therefore commit to integrating ocean-based climate solutions into their NDCs or achieving their NDCs with ocean-climate solutions.^{21 22}

By June 2025, a total of eight countries has joined the initiative, committing to include the ocean in their updated climate plans under the Paris Agreement. Depending on their national context, countries can include, for instance:

- Sustainably managing, conserving, and restoring coastal and marine ecosystems
- Phasing out offshore oil and gas production
- Scaling-up responsible marine renewable energy
- Decarbonising and adapting maritime industries, like shipping
- Fostering sustainable, climate-resilient fisheries and aquaculture

Governments joining the Challenge receive support from partners such as the Ocean Breakthroughs, the UN High-Level Climate Champions, and the NDC Partnership. Together, they aim to accelerate investment and action in ocean-based solutions toward a net-zero, resilient, and nature-positive future by 2050.

3.2 Shipping in existing NDCs

Until recently, the international climate effort and the ocean conservation effort have been largely siloed. Although a majority of countries referenced the ocean in their first round of NDCs (2015–2020), only a minority discussed ocean actions as climate solutions.²³ While updated NDCs increasingly recognize ocean-based mitigation and adaptation measures, shipping-specific targets remain limited and fragmented and are not yet included in the North Sea countries' NDCs despite promising relevant opportunities.

3.2.1 Domestic versus international shipping

Many countries include domestic shipping in their NDCs, typically through measures such as electrification of ferries, port efficiency improvements, and incentives for low carbon fuels. However, this is not the case for the North Sea countries, which generally do not include domestic shipping in their NDCs, and international shipping targets are likewise typically excluded.

²¹ World Resources Institute (2025)

²² Ocean Conservancy (n.d.)

²³ Khan et al. (2022)

The main justification for excluding international shipping targets is that emissions from this sector are regulated through other UN bodies (notably the IMO) and therefore do not need to be reflected in national climate commitments. The challenge is that IMO measures have been introduced only slowly and remain misaligned with the Paris Agreement's 1.5°C trajectory. As a result, international shipping emissions are effectively overlooked: they are omitted from national NDCs while also remaining insufficiently addressed at the international level, leaving a significant regulatory gap.

3.2.2 Current status and trends

By June 2023, 23 countries had included targets for reducing emissions from shipping and ports in their updated NDCs. These targets vary widely in scope and ambition. Most focus on domestic maritime transport and port operations, such as:

- Electrification of short-sea shipping and ferries, for example through battery-powered vessels
- Efficiency measures like slow steaming and optimised routing
- Infrastructure for alternative fuels such as methanol, ammonia, and hydrogen in major ports
- Integration with broader ocean-based climate actions, including marine spatial planning and protection of blue carbon ecosystems²⁴

Recent developments show that shipping-related actions in NDCs increasingly aim to deliver co-benefits for marine ecosystems. Measures such as speed reduction and optimised routing can reduce greenhouse gas emissions while lowering underwater noise and minimizing ship strikes on marine mammals. Electrification of ferries and port operations not only cut CO₂ emissions but also improve local air quality and reduce pollution risks in coastal waters.

It is important to note that, among the 23 countries that have included targets related to emissions from shipping and ports in their NDCs, there are currently no clear examples from North Sea countries that contain explicit and well-defined shipping measures. This gap underscores the relevance of focusing on the North Sea region, as the interviews identified several concrete opportunities for how shipping could be meaningfully integrated into the NDCs of these countries. The findings highlight the relevance of focusing on how the North Sea region can leverage different potentials and address existing barriers for integrating shipping measures in their NDCs.

3.2.3 Examples of current NDCs

Most NDCs focus on energy, land use, and road transport, while maritime transport is often addressed through international frameworks like the IMO rather than national pledges.

For this reason, we have chosen two strong examples, Seychelles and Cabo Verde, that demonstrate how shipping can be integrated meaningfully into national climate strategies alongside commitments to protect marine ecosystems.

²⁴ Khan et al. (2022)

It is important to note that there are currently no examples of clearly defined NDCs from North Sea countries that include explicit shipping measures. While nations like Norway reference shipping indirectly under broader transport targets, they do not provide detailed maritime actions in their NDC commitments. Therefore, we have selected examples from other regions to showcase best practices and inspire future integration of shipping into climate planning.

Examples of integrating shipping into national strategies



Cabo Verde: Linking maritime transport decarbonisation to marine ecosystem resilience

Cabo Verde's NDC 3.0^a includes explicit commitments to decarbonise both domestic and international maritime transport by 2030, and develop policy frameworks and analytical tools to quantify and reduce emissions from shipping.

Impact on biodiversity and marine environment

The NDC outlines a planned 50% expansion of coastal and MPAs, full management plans, and an updated wetlands and seagrass mapping inventory. It aims to embed such blue carbon ecosystems in spatial carbon planning and design nature-based coastal protection solutions.

Impact on shipping

By positioning maritime transport within the national mitigation strategy, with targeted policies and quantification plans, Cabo Verde signals systemic intent to decarbonise shipping, contribute to global climate governance, and align with IMO goals.



Seychelles: Maritime decarbonisation and blue carbon integration

Seychelles' updated NDC targets decarbonising the maritime sector and integrating blue carbon ecosystems into climate mitigation pathways. It commits to transitioning its domestic fleet, and eventually international maritime transport, to low-carbon solutions by 2030. Simultaneously, it pledges to map and monitor seagrass and mangrove systems and include them in the national GHG inventory by 2025, alongside designating 30% of its Exclusive Economic Zone as MPAs via a Marine Spatial Plan.

Impact on biodiversity and marine environment

Through a partnership with Deakin University and the Ministry of Fisheries, Agriculture & Blue Economy, Seychelles quantified its mangrove carbon stocks, finding approximately 700,000 t of organic carbon, offsetting 3% of its annual CO₂ emissions, and demonstrating scientific grounding for protection policies.^b The scale-up to 100% coverage of blue carbon ecosystems by 2030 and full ecosystem protection signals a bold commitment to biodiversity, coastal resilience, and carbon sequestration.

Impact on shipping

The NDC embeds sustainable shipping by requiring the Port Authority to implement the Green Ports Initiative, ensuring future port infrastructure uses renewable energy and reduces marine pollution. This scope marks a strategic alignment between maritime decarbonisation and economic development in port operations.

^a Government of Cabo Verde (2025)

^b Seychelles' Ministry of Agriculture, Climate Change and Environment (2025)

3.3 Barriers to integrating shipping into NDCs

Despite growing recognition of the role shipping must play in meeting global climate goals, North Sea countries still face a complex set of barriers when attempting to integrate the sector into their NDCs. Many of these challenges stem from the inherently international nature of shipping, the division of regulatory responsibilities between global and national arenas, and the sector's tight operating margins and fragmented ownership structures. Together, they create a policy landscape where climate ambition, marine environmental protection and biodiversity objectives are often pursued in parallel rather than through a coherent, integrated approach.

Insights from the interviews underpin that a central obstacle is **the governance gap between national climate strategies and the global regulatory mandate of the IMO**. Because international shipping falls under IMO authority, most countries have historically excluded the sector from their NDCs and instead focused on domestic or coastal shipping. Several interviewees emphasize that this governance split makes it difficult for North Sea states to address the full environmental footprint of the sector. While regional bodies such as OSPAR, HELCOM and the Arctic Council often function as testbeds for more ambitious environmental measures, their influence remains uneven, and global alignment has weakened following setbacks in IMO's negotiations on a net-zero framework. Many negotiators no longer expect IMO alone to deliver the pace of climate action required to stay on a 1.5°C trajectory. This dynamic creates a paradox in which industry actors acknowledge that stronger climate regulation is inevitable, yet prefer it to emerge through multilateral agreement in order to avoid competitive distortions. As a result, national governments in the North Sea region may hesitate to include shipping-related measures in their NDCs due to concerns over carbon leakage, loss of competitiveness, or the relocation of port activity to neighbouring jurisdictions with less stringent requirements. Interviewees pointed to examples from North America where differences in port regulation and environmental standards risk shifting shipping activity between ports rather than reducing overall emissions.

Economic constraints also limit the ability of the sector to move faster. Shipping operates on thin margins, and investment decisions are heavily shaped by cost considerations. Low-carbon fuels such as ammonia, methanol or hydrogen require expensive infrastructure and have lower energy density, making operations more costly. Technical efficiency improvements are widely acknowledged as a "low-hanging fruit", yet incentives remain diluted by complex chartering models where shipowners and operators often split responsibilities for fuel consumption, emissions and revenue. As highlighted by industry actors, investments in hull optimisation or other energy-saving measures do not always benefit the party paying for them, creating hesitation even when the technologies are available. Here, the barrier is less technological than structural, pointing to a gap in how existing market arrangements and policy frameworks distribute risk and reward across the shipping value chain.

Financial institutions confirmed that **clearer and more predictable policy signals** are needed to unlock capital. Existing voluntary frameworks, such as the Poseidon Principles or sustainability-linked loans, help steer climate alignment but rarely incorporate biodiversity considerations. Several interviewees noted that biodiversity risks, including underwater noise or the spread of invasive species through bio-fouling, are still not systematically integrated into credit assessments, even though good data is increasingly demanded by lenders and investors. This suggests that the challenge lies not in data availability alone, but in the lack of integrated methodologies that

connect biodiversity impacts with financial decision-making.

Another barrier is **the operational complexity that arises when climate and biodiversity objectives intersect**. Measures such as re-routing vessels away from sensitive habitats or operating at lower speeds can significantly reduce underwater noise and ship strikes but may increase voyage time and fuel use. Some industry stakeholders have identified around 10 knots as a practical benchmark for balancing commercial efficiency with lower acoustic disturbance and collision risk. Yet, this is not a regulatory requirement, and global enforcement remains unlikely. Ports play an important role here: digital tools such as virtual queuing systems already improve voyage planning and reduce unnecessary anchorage time, and next-generation systems are beginning to integrate ecological sensitivity data. However, the ability to mandate and scale such systems lies primarily with national port authorities, creating variability across jurisdictions in the North Sea region. This uneven implementation underscores the need for deeper insight into how ports can function as experimental and coordinating spaces for integrated climate and biodiversity action.

The interviews also underscored **persistent data gaps**. Reliable, comparable data on emissions, underwater noise, ship-wildlife interactions and broader biodiversity impacts is limited, despite “oceans of knowledge” existing in research environments. The challenge is not a lack of science but the absence of mechanisms that translate knowledge into political or regulatory action. Stakeholders pointed to a missing institutional “home” for shipping in global environmental governance: while fisheries, marine protected areas and pollution have long-established policy communities, shipping has often fallen between domains. As a result, nature-positive practices struggle to gain traction unless directly linked to climate or economic benefits. This points to a structural gap between research, policy and implementation that could form a focal point for future interdisciplinary research efforts.

Finally, there is **a broader political and cultural barrier**. Many countries and companies acknowledge the importance of biodiversity and ocean health, yet few translate this recognition into binding requirements for the maritime sector, including the North Sea countries. Industry pressure is uneven, and political willingness varies significantly across regions. Interviewees highlighted examples, from Vancouver Island to Arctic waters, where environmental protection clearly outweighs short-term economic gains, illustrating that stronger national and regional regulation is possible when nature’s value is fully recognised. But such cases remain exceptions rather than the norm, also in the North Sea region.

Altogether, these barriers reveal why integrating shipping into NDCs requires more than adding emissions targets. It demands new governance mechanisms that bridge global mandates and the mandates of the North Sea countries, clearer economic signals for first movers, credible and consistent data, and a cultural shift that treats climate and biodiversity as intertwined dimensions of the same transition. While many tools already exist, the main task ahead is coordinating them into a coherent and practical framework that North Sea countries can use to align shipping with their broader climate and ocean commitments.

Overview of barriers

Governance gaps

- Governance gap between national climate policy and IMO authority
- International shipping largely excluded from NDCs
- Setbacks in IMO's net zero negotiations have weakened confidence, reducing expectations that the IMO alone can deliver 1.5°C aligned climate action
- Industry seeks stronger climate regulation but prefers multilateral alignment, to avoid competitive distortions between jurisdictions
- National hesitation stems from carbon leakage risks, including fears of competitiveness loss

Economic constraints

- Thin margins constrain investment, making cost a dominant factor in all strategic decisions
- Low carbon fuels increase operating costs, due to both expensive supporting infrastructure and lower energy density
- Efficiency upgrades lack clear incentives, because complex chartering models split responsibility for fuel consumption, emissions, and revenue
- Cost-benefit misalignment creates hesitation, as energy saving measures often do not benefit the actor who pays for them
- Barriers are structural rather than technological, reflecting market arrangements that unevenly distribute risk and reward

Operational complexity at the climate–biodiversity intersection

- Re-routing vessels or reducing speed can reduce underwater noise and ship strikes, but increases voyage time and fuel use
- Regulatory requirement for speed and global enforcement is unlikely
- Digital tools can enhance voyage planning and reduce anchorage time, but scaling depends on national port authorities, leading to jurisdictional variability

Data gaps

- Limited reliable and comparable data (on emissions, underwater noise, ship-wildlife interactions, and biodiversity impacts)
- Absence of mechanisms to translate knowledge into action
- Shipping continues to lack a clear institutional home within global governance, often falling between established policy domains

Political and cultural barriers

- Recognition of biodiversity and ocean health importance, yet few binding requirements for the maritime sector
- Uneven industry pressure and varying political willingness across regions
- Examples of stronger national and regional regulation are still the exception, not the norm

3.4 Potentials for integrating shipping into NDCs

Despite the significant barriers that remain, there is a growing sense across governments, industry and civil society that integrating shipping more fully into North Sea countries' NDCs could unlock powerful opportunities for both climate action and ocean health. Interviews consistently highlighted a shift in thinking: rather than treating biodiversity as an add-on to decarbonisation, future strategies may increasingly view marine ecosystem integrity as a foundation for sustainable maritime transition. This represents a subtle but important recalibration, an ocean-first mindset, that recognises shipping's deep interdependence with marine resilience, coastal communities and global sustainability objectives.

One emerging potential lies in **reframing the sector's environmental agenda** so that biodiversity protection and climate mitigation are understood as mutually reinforcing rather than competing priorities. Measures such as reducing sailing speeds, rerouting traffic away from sensitive habitats or incorporating ecological data into voyage and port planning deliver immediate benefits for marine wildlife not only in the North Sea but also broader internationally. At the same time, they cut fuel consumption, reduce emissions and address operational inefficiencies that the industry itself acknowledges. Interviewees from both government and industry stressed that protecting whales, minimising underwater noise or preventing invasive species are not constraints on decarbonisation, they are enablers of a more efficient and future-proof maritime system.

Embedding such biodiversity measures into NDCs could allow countries to formalise and scale actions that already show promising dual benefits. National marine spatial planning, for example, provides a platform for aligning shipping routes with conservation zones in the North Sea countries, while the establishment of marine protected areas creates regulatory clarity for managing ecological risks. Strengthening pollution controls, on ballast water, bio-fouling or scrubber discharges, directly enhances water quality and ecosystem resilience, and these measures already feature prominently in the portfolios of progressive ports and regions, such as Port of Rotterdam or Port of Gothenburg. As highlighted in interviews, these tools are well understood; the opportunity now is to integrate them into national climate strategies in ways that generate quantifiable and reportable outcomes.

Interviews further highlight **ports as particularly promising entry points for national action** within the framework of NDCs. Unlike international shipping, ports operate firmly within national jurisdictions and sit at the intersection of climate policy, environmental regulation, public health and local economic development. As such, they offer governments a tangible arena in which shipping-related measures can be implemented, monitored and enforced without waiting for global consensus. Interviewees emphasise that port-based measures, such as requirements for cleaner fuels, shore-side electricity, speed management in port approaches, or digital traffic management systems, can deliver immediate reductions in emissions and local pollution for the North Sea countries. These measures are often politically more acceptable because they address visible and locally felt impacts, including air quality, water pollution and risks to marine wildlife, while simultaneously supporting national climate objectives. Integrating port-related commitments into NDCs could therefore allow North Sea countries to anchor shipping action in areas where national competence is clear and co-benefits are strongest. By framing ports as hubs for both climate mitigation and biodiversity protection, NDCs can help scale existing best practices, reduce regulatory fragmentation and create clearer signals for investment in port infrastructure, digital solutions and nature-positive

technologies.

There is also significant potential in the **financial and technological dimensions** of the transition. A number of financial institutions acknowledged that their current focus on climate alignment could be broadened to incorporate biodiversity indicators, particularly as investor expectations evolve and disclosure frameworks mature. Expanding initiatives such as the Poseidon Principles to include ocean-health metrics or ecosystem-risk assessments would create incentives for green technologies that reduce noise, prevent ship strikes or improve waste management. Several interviewees pointed out that this could reposition biodiversity not as a cost but as a value driver supporting blue bonds, enabling concessional finance, and strengthening credibility among investors, regulators and local communities in the North Sea region.

Governments too can use NDCs as **strategic levers for more coherent policymaking**. Interviews emphasised that many North Sea countries already have building blocks for integrated approaches, marine spatial plans, domestic targets for short-sea electrification, or regional cooperation frameworks such as HELCOM, OSPAR and emerging EU regulations. By linking these instruments directly to NDC implementation, North Sea states can reduce policy fragmentation and pave the way for coordinated action on routing protocols, speed management, ecological monitoring and port-infrastructure standards. This also aligns well with global frameworks such as the Kunming-Montreal Global Biodiversity Framework, the BBNJ Treaty and the IMO's developing climate architecture.

Together, these developments suggest that shipping's integration into NDCs could evolve from a narrow emissions-accounting exercise into a broader strategy for ocean stewardship. Rather than positioning the sector solely as a source of greenhouse gases, this approach highlights its potential as an active contributor to restoring marine ecosystems, supporting coastal livelihoods and advancing a resilient blue economy. The tools already exist; the opportunity now lies in combining them into holistic national strategies that treat climate and biodiversity as inseparable pillars of a sustainable maritime future.

Overview of opportunities

Biodiversity protection and climate mitigation as complementary

- Measures such as reducing sailing speeds, re-routing traffic, and incorporating ecological data create immediate benefits for marine wildlife, reduced fuel consumption, emissions, and operational inefficiencies
- Including biodiversity measures in NDCs (e.g., protecting whales, minimising underwater noise) can enable an efficient, future-proof maritime system and allow countries to formalise and scale actions with promising dual benefits
- Strengthening pollution controls enhance water quality and ecosystem resilience

Financial and technological dimensions

- Opportunities for financial institutions in expanding their climate focus to include biodiversity e.g., by expanding Poseidon Principles to include ocean-health metrics and ecosystem-risk assessments which could create incentives for green technologies
- Biodiversity as a value driver strengthens credibility among investors, regulators, and local communities

More coherent policymaking

- Linking already existing instruments (e.g., marine spatial plans, domestic targets for short-sea electrification, or regional cooperation frameworks) directly to NDC implementation can help states reduce policy fragmentation and pave the way for coordinated action

3.5 Engaging stakeholders for integrated action

Successfully integrating shipping into NDCs depends not only on regulatory design but on the ability to convene a broad community of stakeholders across industry, government, research and civil society. As the interviews make clear, current engagement remains fragmented, and the sector often lacks the connective tissue needed to translate scientific knowledge and policy ambitions into coordinated action. Yet these very gaps also present opportunities to build more inclusive, informed and resilient approaches.

A central need identified across interviews is a closer relationship between research and practice. Although there is an abundance of scientific knowledge on marine ecosystems, underwater noise, ship-wildlife interactions and emission patterns in the North Sea region, this information seldom finds its way into operational decision-making. Much of the existing data remains underused because mechanisms for collaboration between scientists, ports, operators and regulators are limited. Stakeholders repeatedly stressed that improved data quality, combined with shared monitoring standards, would enable more adaptive and evidence-based management. Embedding this scientific foundation into North Sea countries' national frameworks, including NDC implementation, would help ensure that biodiversity safeguards and climate measures rest on a transparent understanding of risk and ecological impact.

Interviews also highlighted the persistent absence of strong demand signals from consumers. Even as companies and financial institutions operating in the North Sea region increasingly align with climate strategies, the willingness of end-users to pay for low-emission or biodiversity-friendly maritime transport remains low. This weakens

incentives for first movers and slows investment in cleaner technologies. Some interviewees pointed to the potential of greater transparency: clearer reporting on emissions, underwater noise footprints or biodiversity impacts could make the environmental cost of maritime transport more visible and begin shifting expectations. Over time, improved traceability and disclosure, particularly as ESG frameworks evolve, may help generate the market pressure needed to support greener operations in the North Sea.

Civil society and NGOs in the North Sea region emerged as another crucial component of integrated action. Several interviewees described their role as essential for connecting global commitments to local realities. NGOs can monitor implementation, advocate for measures such as speed limits in ecologically sensitive areas, and push for stronger regulation of ballast water, bio-fouling or port pollution in the region. Their engagement also provides the social legitimacy that climate and biodiversity policies require to endure. Including local communities, fishers, coastal businesses and Indigenous groups in decision-making processes not only broadens the knowledge base but ensures that NDC measures reflect the lived realities of those most directly affected by maritime activity in the North Sea countries.

Interviews further underscored the importance of practical policy tools that can support governments in the North Sea region in structuring stakeholder engagement around NDC implementation. Interviewees pointed to guidance frameworks, such as sector-specific NDC toolkits, as mechanisms that can help translate broad climate and biodiversity ambitions into actionable and inclusive processes. Experiences from other maritime sectors suggest that well-designed NDC guidance can function not only as a technical resource but also as a convening instrument. When governments articulate clearer implementation pathways, including indicative measures, timelines and monitoring approaches, stakeholders are better able to align their own strategies, investments and research agendas accordingly.

Taken together, the interviews suggest that stakeholder engagement is not a supportive add-on but a structural requirement for integrating shipping into NDCs not only for North Sea countries but also more broadly. More collaborative, transparent and socially grounded processes can help bridge the gaps between science and practice, align incentives across the value chain, and build the legitimacy needed for durable and ambitious implementation.

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5 Appendices

5.1 Appendix 1. Methodology – Interviews

The interview study is part of the project's knowledge assessment, where we conduct a series of expert interviews with relevant stakeholders in the field. The interviews are intended to inform and qualify a systematic mapping of existing knowledge and opportunities related to the integration of shipping into NDCs. Therefore, the interviews will help to enhance the understanding of the opportunity space for integrating shipping goals in NDCs, with consideration of marine environment and biodiversity.

As part of the project's knowledge mapping, a total of seven expert interviews with relevant stakeholders in the field of shipping have been conducted. Experts representing different links in the value chain of shipping were identified to establish and validate the differentiated viewpoints within each link and to clarify their relevance for the project. Consequently, experts included:

- Lloyds Register
- Uppsala University
- Sustainable Shipping Initiative Secretariat
- Danish Ship Finance
- Danish Ministry of Environment and Gender Equality
- University of Aarhus
- Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping

Although international representation was prioritised, given that the scope of the assignment is focused on the North Sea region, it was particularly challenging to reach national authorities in countries other than Denmark and international NGO representatives.

The recruitment strategy for the interview investigation was designed to ensure relevant, diverse, and knowledgeable participation across the key stakeholder groups mentioned above. Participants were selected based on their expertise, institutional role, and relevance to the research topic. A combination of purposive and snowball sampling was used: initial participants were identified through the Velux Foundation's professional network while additional interviewees were recruited through recommendations from earlier participants.

Potential participants were contacted via email invitations, which included information about the project's purpose and interview format. Participation was voluntary, and all respondents provided informed consent prior to the interview. The interviews were conducted virtually via Teams. Each interview transcript was subsequently reviewed and sent to the interviewees in a summarized format for validation. This process ensured the reliability of the data, as all interview material was validated and approved by the participants before inclusion in the analysis. The interviews comprised three different themes, each representing a key focus area vital to the understanding

of the opportunity space for integrating shipping goals in NDCs, with consideration of marine environment and biodiversity. The three main themes are presented below, along with examples of interview questions:

1. Climate and marine environmental goals in NDCs

- What potential co-benefits could arise for biodiversity and marine ecosystems from integrating shipping into NDCs?
- What are the main challenges or barriers to integrating shipping into NDCs?

2. Regulation and governance

- How do different regulatory frameworks covering climate and the marine environment in the North Sea (IMO, OSPAR, EU) interact with each other?
- Where are the gaps, and where are the opportunities to link climate and marine environmental considerations more closely in the North Sea?

3. Social and stakeholder perspectives

- How can civil society be more effectively involved in linking climate goals with marine environmental objectives?
- What are the key considerations for creating legitimacy and acceptance?

After having conducted all interviews, a validation workshop was organised between Velux Foundation, Mary Wysz, and Ramboll. The workshop had the purpose of ensuring accuracy, relevance, and shared understanding between all parties before proceeding to full analysis and reporting. The aim of the workshop was to 1) verify preliminary findings and interpretations, 2) ensure contextual accuracy, 3) prioritise focus areas for the analysis, 4) enhance stakeholder ownership and engagement in the analysis and, 5) refine the analytical framework.

5.2 Appendix 2. Environmental and governance overview

The table on the following page illustrates the three-tier architecture of environmental regulation in shipping. For each level of governance, it highlights the most relevant institutions and legal foundations, the primary policy levers employed, and the implementation and effects specifically relevant to the North Sea region. The table provides a complementary overview, enabling a more visual comparison of the three regulatory frameworks and demonstrating the specific tools they employ and their associated impacts in a North Sea context.

Figure A.1. Comparative overview: Three-tier environmental governance of shipping

Level	Institutions and legal core	Primary policy levers	Implementation & effects (North Sea context)
 Global	IMO (UN specialised agency). Under IMO, the <i>MARPOL Convention</i> (International Convention for the Prevention of Pollution from Ships) is the main legal instrument for preventing pollution from ships. IMO's Marine Environment Protection Committee (MEPC) is the technical body that develops and enforces environmental regulations.	- Emissions standards / climate and decarbonization: MARPOL Annex VI, IMO GHG Strategy (2023), Carbon pricing / Market-Based Measures, Ship design & efficiency. - Pollution prevention / air and water pollution: MARPOL Annex I–V. - Marine environment and biodiversity protection: Ballast Water Management Convention, Biofouling guidelines, Underwater noise guidelines / URN Action Plan, Particularly Sensitive Sea Areas (PSSAs). - Marine litter, noise and invasive species: MARPOL Annex V, Ballast water & biofouling conventions, Underwater noise guidelines. - Monitoring, assessment and knowledge: IMO Data Collection System (DCS). - Cross-sector and spatial planning: IMO can provide guidance on routing, PSSAs, & operational measures.	Design-related, globally harmonised standards (engines, fuel systems, pollution controls); uniform MRV and enforcement via flag/port States ensures minimum global standards and market stability. The regulatory scope remains narrowly focused on climate, while biodiversity and marine ecosystem concerns are largely absent. Climate measures are mandatory and measurable (EEXI, CII, global GHG intensity standards, DCS) with uniform MRV and enforcement systems. Marine environment and biodiversity measures are mostly voluntary or weakly enforced, such as the non-mandatory biofouling guidelines and advisory underwater noise guidance.
 Regional	The <i>EU</i> is the strongest regional regulator for maritime climate and environmental policy in the North Sea region. OSPAR is the leading marine environment and biodiversity governance body for the North Sea region. Focus on environmental protection, not climate mitigation.	- Emissions standards / climate and decarbonization: <u>EU</u>: EU ETS – Maritime (2024–27); FuelEU Maritime (2025); European Green Deal/Fit for 55. <u>OSPAR</u>: No climate-specific levers; focuses on environmental pressures. - Pollution prevention / air and water pollution: <u>EU</u>: Water Framework Directive (WFD); SECAs. <u>OSPAR</u>: Regional Action Plans; Eutrophication & contaminant reduction programmes. - Marine environment and biodiversity protection: <u>EU</u>: MSFD; Habitats & Birds Directives; Natura 2000 MPAs; EIA Directive. <u>OSPAR</u>: MPA network (incl. ABNJ); Measures for threatened/declining species and habitats. - Marine litter, noise and invasive species: <u>EU</u>: Indirect coverage via MSFD descriptors and WFD. <u>OSPAR</u>: Marine Litter Action Plan; Noise & underwater sound initiatives; Regional coordination on ballast water and invasive species. - Monitoring, assessment and knowledge: <u>EU</u>: MSFD monitoring and reporting obligations. <u>OSPAR</u>: QSRs; Common indicators & monitoring programmes; JAMP - Cross-sector and spatial planning: <u>EU</u>: MSP Directive (spatial allocation and routing). <u>OSPAR</u>: Regional MSP principles; Cumulative impact frameworks (shipping, energy, fisheries, climate).	EU law builds on—and in some areas goes beyond – IMO baselines by creating binding regional obligations and financing mechanisms. OSPAR ensures ecological coherence across both EU and non-EU waters. In practice, the regimes operate largely in parallel, resulting in coordination gaps and fragmented governance. Climate policy tends to advance faster than marine environment and biodiversity policy, creating misalignment between decarbonisation efforts and ecosystem protection needs. Limited cross-regime coordination means measures are developed separately (e.g., GHG reduction vs. MPA protection), leading to policy silos and missed opportunities for integrated, cross-cutting solutions.
 National	<i>North Sea States</i> (EU members and non-EU: UK, NO). National climate laws; marine strategies; port-level rules (OPS use, waste reception, scrubber policies); MPA management; spatial planning.	- Emissions standards / climate and decarbonization: Public-private partnership to scale zero-emission fuels and vessels, Support for clean tech, innovation, & zero-emission ships, Shore-power subsidy for ports to reduce local emissions. - Pollution prevention / air and water pollution: Support for zero-emission shipping reducing NO_x, SO_x, air pollutants, Green Award certification for ships that surpass environmental standards (lower-pollution vessels). - Marine environment and biodiversity protection: National climate-shipping policy drives zero-emission fuels, Green Award scheme rewarding pioneer vessels with environmental certification. - Marine litter, noise and invasive species: Supporting technologies that also reduce noise & discharges, Incentivising clean shipping through Green Award. - Monitoring, assessment and knowledge: National climate fund investing in sustainable fuel infrastructure & monitoring approaches, Research on ship-based carbon capture, energy demand, shore-power systems. - Cross-sector and spatial planning: National maritime-spatial planning integrating shipping, offshore wind, & environmental protection.	National authorities are responsible for domestic implementation, permitting, enforcement, and targeted navigation measures (e.g. speed limits, routing, or seasonal restrictions near sensitive areas). They operationalise global and regional frameworks while allowing for higher ambition and more tailored ecological measures. Differences in ambition and timing across North Sea countries create regulatory heterogeneity. National climate and marine policies advance at varying speeds; some states adopt early zero-emission incentives or strict biodiversity protections; others move more gradually. Divergent implementation of IMO rules, EU directives, and national protections lead to uneven requirements, ecological outcomes, and higher compliance and routing costs for operators moving between jurisdictions.

5.3 Appendix 3. International examples of ocean-based climate action in NDCs

This appendix presents a curated set of country examples illustrating how ocean-based climate solutions are incorporated into NDCs under the Paris Agreement. The examples are derived from the *Ocean-Based Climate Solutions in Nationally Determined Contributions: June 2023 Update*, which reviews 98 NDC submissions to identify concrete mitigation and adaptation actions linked to the ocean.

1. Scaling-up offshore renewable energy

- Democratic Republic of the Congo
- Dominica
- Equatorial Guinea
- Mauritania
- Namibia
- Nauru
- Singapore
- Thailand
- Tunisia
- Türkiye
- Tuvalu
- United Kingdom
- United States
- Viet Nam

2. Reducing emissions from shipping and ports

- Cabo Verde
- Canada
- China
- Dominica
- Equatorial Guinea
- Fiji
- Japan
- Maldives
- Monaco
- New Zealand
- Norway

- Republic of Korea
- Republic of the Marshall Islands
- Samoa
- Saudi Arabia
- Seychelles
- St. Lucia
- Türkiye
- United Kingdom
- United Republic of Tanzania
- United States
- Vanuatu
- Venezuela

3. Reducing emissions from offshore oil and gas

- Brunei Darussalam
- Canada

4. Protecting and restoring blue carbon ecosystems

- Antigua and Barbuda
- Argentina
- Australia
- Bahamas
- Benin
- Cabo Verde
- Cambodia
- Cameroon
- Canada
- Chile
- China
- Colombia
- Costa Rica
- Cuba
- Dominican Republic
- El Salvador

- Equatorial Guinea
- European Union
- Fiji
- Guatemala
- Guinea
- Haiti
- Honduras
- Iceland
- Indonesia
- Jamaica
- Kenya
- Kiribati
- Lebanon
- Malaysia
- Maldives
- Mauritius
- Mexico
- Mozambique
- Namibia
- New Zealand
- Norway
- Pakistan
- Panama
- Papua New Guinea
- Republic of Korea
- Samoa
- Saudi Arabia
- Senegal
- Seychelles
- Singapore
- Solomon Islands
- Somalia

- St. Lucia
- Sudan
- Timor-Leste
- Togo
- Tunisia
- United Arab Emirates
- United Kingdom
- United Republic of Tanzania
- United States
- Uruguay
- Vanuatu
- Venezuela
- Vietnam

5. Advancing MPAs

- Albania
- Bahamas
- Cabo Verde
- Canada
- Chile
- Costa Rica
- Dominica
- Egypt
- Fiji
- Gabon
- Guatemala
- Honduras
- Indonesia
- Malaysia
- Micronesia (Federated States of)
- Namibia
- Papua New Guinea
- Senegal

- Seychelles
- Solomon Islands
- St. Lucia
- Timor-Leste
- Tonga
- United Arab Emirates
- United Kingdom
- Uruguay
- Vanuatu
- Venezuela

6. Protecting coastal communities and infrastructure

- Albania
- Angola
- Antigua and Barbuda
- Argentina
- Bahamas
- Benin
- Brunei Darussalam
- Cabo Verde
- Cameroon
- Canada
- Chile
- Democratic Republic of the Congo
- Cuba
- Dominica
- Dominican Republic
- Egypt
- Fiji
- Gabon
- Guinea
- Haiti
- India

- Indonesia
- Ivory Coast
- Kenya
- Kiribati
- Lebanon
- Malaysia
- Maldives
- Mauritania
- Mauritius
- Micronesia (Federated States of)
- Monaco
- Mozambique
- Namibia
- Nauru
- Panama
- Papua New Guinea
- Philippines
- Republic of Korea
- Russia
- Saint Kitts and Nevis
- Sao Tome and Principe
- Saudi Arabia
- Senegal
- Seychelles
- Singapore
- Somalia
- St. Lucia
- Sudan
- Thailand
- Tonga
- Tunisia
- Tuvalu

- United Arab Emirates
- United Republic of Tanzania
- United States
- Uruguay
- Vanuatu
- Venezuela

7. Protecting coastal and marine ecosystems and biodiversity

- Antigua and Barbuda
- Argentina
- Cabo Verde
- Cambodia
- Canada
- Colombia
- Cuba
- Dominican Republic
- Equatorial Guinea
- Fiji
- Gabon
- Guatemala
- Lebanon
- Malaysia
- Maldives
- Mexico
- Namibia
- Oman
- Panama
- Papua New Guinea
- Philippines
- Seychelles
- St. Lucia
- Sudan
- Thailand

- Togo
- United Arab Emirates
- United Kingdom
- Uruguay

8. Creating climate-ready fisheries

- Albania
- Angola
- Antigua and Barbuda
- Argentina
- Benin
- Cabo Verde
- Cambodia
- Chile
- Comoros
- Democratic Republic of the Congo
- Costa Rica
- Cuba
- Dominica
- El Salvador
- Fiji
- Haiti
- Ivory Coast
- Jamaica
- Kenya
- Kiribati
- Lebanon
- Malaysia
- Maldives
- Mauritius
- Micronesia (Federated States of)
- Mozambique
- Namibia

- Nauru
- Oman
- Papua New Guinea
- Peru
- Russia
- Sao Tome and Principe
- Senegal
- Seychelles
- Somalia
- Sudan
- St. Lucia
- Timor-Leste
- Togo
- Tonga
- Tuvalu
- United Arab Emirates
- United Kingdom
- Vanuatu
- Vietnam

9. Advancing ocean-climate justice

- Antigua and Barbuda
- Argentina
- Cabo Verde
- Cambodia
- Canada
- Dominica
- Kiribati
- Maldives
- Monaco
- Republic of Korea
- Russia
- St. Lucia

- United Kingdom
- Uruguay

10. Enhancing a blue economy

- Argentina
- Cabo Verde
- Dominica
- Equatorial Guinea
- Mozambique
- Seychelles
- United Kingdom
- United Republic of Tanzania



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