
PROTECTING MARINE BIODIVERSITY FROM SHIP-GENERATED POLLUTION: ASSESSING INDIA'S PREVENTIVE LEGAL AND REGULATORY FRAMEWORK

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ABSTRACT

Marine ecosystems are important for their role in sustaining ecological balance, biodiversity, food security, and coastal livelihoods. Marine life is increasingly affected by pressures associated with the Anthropocene, including ocean acidification and pollution generated by marine vessels. Ships generate pollution, including oil, sewage, garbage, cargo residues, and other operational discharges, threatening marine organisms and coastal ecosystems. Marine biodiversity is also at risk from vessel collisions, particularly in high-traffic corridors, and from greenhouse gas emissions generated by shipping activity.

India's approach to marine pollution is an amalgamation of international obligations and domestic legislation. Internationally, discharges of oil, sewage, and garbage are regulated by MARPOL 73/78; coastal and flag state duties by UNCLOS; transfer of invasive species by the Ballast Water Management Convention; and shipping emissions by the IMO's greenhouse gas strategy. India implements these obligations through the Merchant Shipping Act 2025, the Environment (Protection) Act 1986, the Coastal Regulation Zone framework, the Water Act 1974, and the Biological Diversity Act 2002. This paper critically examines the effectiveness of this framework in protecting marine biodiversity from ship-generated pollution and identifies gaps in its implementation and enforcement. In doing so, it asks whether India's legal architecture adequately addresses the specific ecological harm caused by ships and vessels or whether structural and enforcement gaps leave marine biodiversity inadequately protected.

Adopting a doctrinal and qualitative methodology, this paper analyses relevant legislation, conventions, judicial decisions, and pollution incidents. The Ennore spill in 2017 leaked up to 196 tonnes of bunker fuel, subsequently linked by a peer-reviewed study to gill damage in coastal crabs. Olive Ridley turtles continue to die from trawler bycatch, with 6,320 deaths recorded in the 2019 to 2020 season alone. These incidents suggest that India's laws are comprehensive on paper but inconsistently enforced and

fragmented in practice, a pattern that recurs across successive rounds of legislative reform rather than resulting from any single failure. The paper concludes by proposing measures to close the gap between what new laws promise and what they actually change.

Keywords: marine pollution, ship-generated pollution, MARPOL, marine biodiversity, enforcement.

Introduction

Marine ecosystems sustain ecological processes, support global biodiversity, and underpin the food security and livelihoods of coastal communities. Their protection has become central to contemporary international environmental law, in part because pressures on the ocean have grown alongside global maritime trade. International shipping is the primary means by which this trade moves: around eighty percent of the volume of international trade in goods is carried by sea, and the share is higher still for many developing economies.¹ The same activity that connects the global economy to distant markets also produces a distinct category of marine pollution, generated not by land-based industry but by the operation of ships themselves.

India occupies a position in which the benefits of maritime trade and the ecological costs of ship-generated pollution are both acutely present. The country has a long coastline supporting dense fishing communities and some of the busiest shipping lanes in the northern Indian Ocean, and it continues to expand its port capacity and coastal infrastructure.²³ India is a party to the principal international conventions governing pollution from ships and has, over several decades, built a domestic legal architecture that draws on those obligations, most recently through the enactment of the *Merchant Shipping Act 2025* in place of the *Merchant Shipping Act 1958*.⁴ Yet recurring incidents suggest that the existence of a legal framework does not, by itself, guarantee protection for marine life.

The problem this paper addresses is not the absence of law but a recurring gap between the law as written and the law as applied, one that survives successive rounds of legislative modernisation rather than being resolved by them. India's statutes and the international

¹ U.N. Conference on Trade & Dev., Review of Maritime Transport 2018, at 1 (2018), https://unctad.org/system/files/official-document/rmt2018_en.pdf.

² Comptroller & Auditor Gen. of India, Performance Audit of Coastal Regulation Zone Notifications, Report No. 3 of 2022, Executive Summary.

⁴ The Merchant Shipping Act, No. 24 of 2025, India Code, <https://www.indiacode.nic.in/bitstream/123456789/22147/1/202524eng.pdf>.

conventions they incorporate assign responsibility for implementation to identifiable institutions, including the Directorate General of Shipping, the Indian Coast Guard, port authorities, and pollution control boards. Whether each new statute actually closes the implementation gap left by the one it replaces or simply modernises the text while leaving that gap in place is largely unexamined in the existing literature, which tends to describe the applicable statutes comprehensively without asking that question.

The significance of this inquiry lies in the ecological and economic stakes involved. Marine biodiversity loss along a coastline supporting millions of fishing-dependent livelihoods carries consequences extending well beyond the immediate site of a spill, and the frequency of large vessel incidents in Indian waters, including the sinking of the MSC Elsa 3 off Kerala in 2025, indicates the risk is neither historical nor confined to a single region.⁵

The research gap this paper addresses is the absence of a sustained critical analysis connecting the international framework, the domestic framework, and the documented record of implementation into a single line of argument, since existing accounts tend to treat each new statute as a fresh start without asking whether it reproduces the gaps of the instrument it replaces. This paper attempts to close that gap by reading the international and domestic frameworks together with the available evidence of enforcement outcomes, including the text of India's newest maritime statute itself.

The objectives of this paper are to identify the major forms and sources of ship-generated waste; to examine the international legal framework governing such pollution; to examine how these obligations are incorporated into India's domestic framework; to identify gaps in implementation, monitoring, compliance, and enforcement; and to propose measures capable of improving effectiveness.

These objectives are pursued through five research questions: what are the major forms and sources of ship-generated waste; what international frameworks govern such pollution; how are these obligations incorporated into India's domestic framework; what gaps exist in implementation, monitoring, compliance, and enforcement; and what measures could improve the framework's effectiveness?

⁵ Kerala Declares MSC ELSA-3 Shipwreck a State-Specific Disaster, *Marine Insight* (2025).

This paper adopts a doctrinal and qualitative methodology, drawing on international conventions, Indian legislation, judicial and tribunal decisions, government reports, port state control data, and peer-reviewed literature concerning documented marine pollution incidents. The Ennore oil spill and the sinking of the MSC Elsa 3 are used as principal case studies to test how the applicable legal framework operates in practice. The mortality of Olive Ridley turtles is used separately as a supplementary example of institutional fragmentation between shipping, fisheries, and wildlife regulation, rather than as a direct example of MARPOL ship-pollution non-compliance. Because a doctrinal reading of the law alone cannot establish whether regulatory mechanisms operate effectively in practice, the paper combines legal analysis with documentary evidence from official regulatory reports, judicial records, and peer-reviewed studies.

Table 1: Methods used in this paper and the question each is directed at

Method	What it examines
Doctrinal analysis of conventions and statutes	The formal content and structure of the obligations of UNCLOS, MARPOL, the Ballast Water Management Convention, and Indian statutes actually impose
Doctrinal analysis of judicial and tribunal decisions	How courts and the National Green Tribunal have interpreted and applied those obligations, and what remedies they have in fact ordered
Documentary and quantitative analysis of official data (Directorate General of Shipping port state control reports, Comptroller and Auditor General audits, Indian Ocean Memorandum of Understanding statistics)	Whether the formal obligations are actually implemented, at what rate, and against which risk categories of vessels
Case study analysis (the Ennore oil spill and the sinking of the MSC Elsa 3)	Whether the doctrinal framework and documented implementation evidence together help explain the regulatory response to two major marine casualties.

The scope of the paper is limited to pollution generated by the operation of ocean-going and coastal merchant vessels, namely oil, sewage, garbage and plastics, and cargo residues, together with the transfer of invasive species through ballast water and greenhouse gas emissions from shipping. It does not extend to land-based sources of marine pollution, to naval or defence vessels, or to a comprehensive treatment of fisheries law, though the regulation of mechanised fishing vessels is discussed in Chapter Six insofar as it intersects with the wider argument about institutional fragmentation.

The paper is subject to several limitations. It relies on doctrinal and documentary analysis rather than empirical fieldwork, and its assessment of implementation is accordingly limited to what is disclosed in public reports, judicial records, and peer-reviewed studies. Data on port-level compliance across India's numerous minor and intermediate ports is not comprehensively published, which constrains generalising from major ports and well-documented incidents to the sector as a whole. *The Merchant Shipping Act 2025* has since been brought *into force with effect from 15 March 2026*, so its practical effect can now begin to be assessed, though much of the implementation evidence examined here necessarily predates that commencement.⁶

Ship-Generated Marine Pollution

Ship-generated waste refers to the range of substances produced in the course of a vessel's normal operation, cargo carriage, and maintenance, as distinct from pollution originating on land or from offshore installations. The International Maritime Organization's principal instrument on the subject, MARPOL, organises this waste into six categories addressed by its technical annexes, namely oil, noxious liquid substances carried in bulk, harmful substances carried in packaged form, sewage, garbage, and air emissions.⁷ Each category presents a different pathway of harm to marine organisms and coastal ecosystems.

Oil pollution arises both from routine operational discharges, such as bilge water and sludge from machinery spaces, and from accidental releases following collision or structural failure. The 2017 collision between two tankers off Ennore near Chennai, discussed in Chapter Five,

⁶ The Merchant Shipping Act, No. 24 of 2025, s 1(2) & n.1, India Code (as of 1 July 2026), <https://www.indiacode.nic.in/bitstream/123456789/22147/1/202524eng.pdf> (recording commencement by Notification No. S.O. 1244(E), dated 10 March 2026).

⁷ Int'l Mar. Org., International Convention for the Prevention of Pollution from Ships (MARPOL), [https://www.imo.org/en/about/Conventions/Pages/International-Convention-for-the-Prevention-of-Pollution-from-Ships-\(MARPOL\).aspx](https://www.imo.org/en/about/Conventions/Pages/International-Convention-for-the-Prevention-of-Pollution-from-Ships-(MARPOL).aspx) (last visited Sept. 8, 2026).

illustrates this pathway. A peer-reviewed histological study of the shore crab *Grapsus albolineatus*, sampled after the spill, recorded structural deformities and irregular gill tips together with reduced haemocyte counts, consistent with sustained hydrocarbon exposure.⁸

Sewage discharged from ships, particularly from passenger vessels with large crews, introduces pathogens, nutrients, and organic matter into coastal waters, contributing to eutrophication in enclosed or poorly flushed waters such as estuaries and harbour basins. Its regulation turns substantially on the distance from land at which discharge occurs, a point addressed further in Chapter Three.

Garbage generated aboard ships, including plastics, packaging, food waste, and cargo dunnage, poses a particular hazard because plastic persists in the marine environment, breaks into microplastic fragments rather than degrading, and is frequently ingested by or entangles marine organisms. The sinking of the MSC Elsa 3 off Kerala in May 2025 demonstrated this at scale: plastic pellets from ruptured containers accumulated on Thiruvananthapuram beaches, and state authorities warned of heightened microplastic pollution.⁹

Cargo residues range from relatively inert bulk commodities to substances directly hazardous to marine life when released in quantity: the MSC Elsa 3 was carrying more than six hundred containers, thirteen holding hazardous material, including calcium carbide, which reacts with seawater to produce flammable gas, together with 84.44 tonnes of diesel and 367.1 tonnes of furnace oil.¹⁰

A further, less visible, source of ship-generated harm arises from ballast water taken on for stability and discharged at a different location, which can carry aquatic organisms and pathogens across ocean basins and introduce them into ecosystems where they have no natural predators.¹¹ Taken together, these categories of ship-generated pollution act cumulatively on marine biodiversity rather than in isolation, since a single vessel casualty, as the case studies discussed later in this paper demonstrate, can release oil, cargo residues, and garbage

⁸ N. Selvakumar, K. Dhanasekar, P. Whaiprib & N. Munuswamy, Impact of January 2017 Oil Spill on the Biota off Chennai, Southeast Coast of India with Emphasis on Histological Impact on Crab, *Grapsus albolineatus*, 59 J. Marine Biological Ass'n India 68 (2017).

⁹ Kerala Declares MSC ELSA-3 Shipwreck a State-Specific Disaster, *supra* note 4.

¹⁰ MSC ELSA 3 Capsizes off Kerala, Incident Overview, Tradlinx (2025); MSC ELSA 3 Sinks off Kochi Coast, Containers Fall into Sea, The South First (May 25, 2025).

¹¹ Int'l Mar. Org., Global Treaty to Halt Invasive Aquatic Species Enters into Force (Sept. 8, 2017), <https://www.imo.org/en/MediaCentre/PressBriefings/Pages/21-BWM-EIF.aspx>.

simultaneously.

International Legal Framework: A Preventive Regime, or a Distributed One?

The international law governing ship-generated pollution is often presented as a settled hierarchy: UNCLOS supplies general obligations, MARPOL supplies detailed discharge standards, and the Ballast Water Management Convention closes a residual gap. That description is accurate, but it answers the wrong question for the purposes of this paper. The question that matters is not what the framework requires in the abstract, but who is actually positioned to stop a polluting or unseaworthy vessel before it causes harm, and whether that structure functions as a preventive system or merely as a mechanism for allocating responsibility after the fact. This chapter argues that the jurisdictional architecture UNCLOS creates, which rests heavily on port state control as the backstop against flag state failure, is not inherently preventive, and that India's own practice illustrates why.

Port state control is the exercise, by a state in whose port a foreign vessel calls, of the power to inspect that vessel for compliance with international safety, labour and pollution prevention conventions, and to detain, delay, or deny entry to vessels found deficient, regardless of the standards actually applied by the vessel's own flag state. It exists because primary responsibility for a vessel's compliance rests with its flag state, and that responsibility is, in practice, unevenly discharged: flag states vary enormously in inspection rigour, and a vessel under a permissive flag can operate for years without a deficiency being identified. Port state control developed, largely through regional memoranda of understanding, to compensate for this gap. India is a founding member of the relevant regional arrangement, the Indian Ocean Memorandum of Understanding on Port State Control.¹²

UNCLOS provides the legal basis for this arrangement. Article 211 directs states to act, individually or through the competent international organisation, to establish international rules to prevent vessel source pollution, and Articles 211(4), 218, and 220 distribute enforcement jurisdiction between flag, port, and coastal states, permitting a port state to investigate a discharge violation that occurred beyond its own waters where a vessel enters its port

¹² Indian Ocean Memorandum of Understanding on Port State Control, Twenty Seventh Committee Meeting, Press Release (Dar es Salaam, 26–30 Aug. 2024), https://www.iomou.org/HOMEPAGE/pdf/Committee_Meetings/IOCM27_PressRelease.pdf.

voluntarily.¹³ This structure achieves prevention only if the port state entry point is used affirmatively, to catch and correct deficiencies before a casualty occurs, rather than passively, to gather evidence after one has already happened. Whether India's port state control regime functions in the first sense or the second is an empirical question, not a textual one, and it is a fair question to put directly: is port state control in India, as actually practiced, preventive of pollution casualties? The evidence in this chapter suggests that the answer is no, not because India lacks the institutional capacity to make it preventive, but because the specific legal mechanism required to make it preventive has not been extended to pollution matters, even in the newest governing statute.

The Directorate General of Shipping's own port state control data illustrates the point. In 2024, India conducted 512 port state control inspections of foreign vessels calling at Indian ports, registering 39 detentions, a detention rate of 7.6 percent.¹³ The same report records that Vessels over twenty years of age constituted just under twenty percent of all inspections but accounted for over forty percent of total detentions, and states in its own words that this

"reaffirms[s] the need for targeted oversight."¹⁴ That finding matters because it means the Directorate had already identified, from its own inspection data, the precise risk category, ageing vessels with degraded maintenance histories, into which the MSC Elsa 3 fell when it sank off Kerala in 2025 after reporting the casualty in part to poor maintenance and defective equipment.¹⁵ The casualty was not an unforeseeable event. It was a realisation of a risk pattern the regulator's own statistics had already flagged, which raises the question of why that pattern had not yet been converted into a binding, risk-based inspection requirement.

The *Merchant Shipping Act 2025* offers a direct way to test whether it has. The Act deals with pollution prevention specifically in Part Seven, **sections 131 to 143**, which empower the Central Government to control the discharge of harmful substances, to deny entry to, detain, or move a vessel, and to require valid pollution prevention certificates before a vessel proceeds to sea.¹⁶ Part Eight, **sections 144 to 152**, separately empowers surveyors to conduct inspections

¹³ United Nations Convention on the Law of the Sea arts. 192, 194, 211, 218, 220, Dec. 10, 1982, 1833 U.N.T.S.

¹³ Directorate Gen. of Shipping, Port State Control and Flag State Implementation Annual Report 2024, at 4–5, https://betadgs.dgshipping.gov.in/download/1754148930_688e30427bafa_202505131206545172062annualreport2024-onlineversion-compressed.pdf.

¹⁴ Id.

¹⁵ Poor Maintenance, Defective Equipment and Crew's Carelessness Caused MSC Elsa 3 Sinking, Investigation Reveals, Marine Insight (2025).

¹⁶ The Merchant Shipping Act, *supra* note 3, ss 133, 135, 137.

and verify compliance with convention requirements.¹⁷ These are the tools of port state control, but nowhere in either part is an inspecting authority required to target inspections by vessel age, maintenance history, or any other risk profile. That silence is a legislative choice rather than an oversight, because the same Act draws the opposite choice elsewhere. Section 77, dealing with port state responsibilities under the Maritime Labour Convention, requires the Director General to notify a system of port state inspections that includes an electronic inspection database “specifying the risk profile of all vessels calling at Indian ports.”¹⁸ Section 77 demonstrates that the 2025 Act is capable of incorporating an expressly risk-based inspection mechanism, and did so, for the protection of seafarers’ labour rights. It did not extend the same mechanism to the pollution prevention provisions of Part Seven, where inspection remains a general power rather than a risk-targeted obligation.

This is not evidence that India lacks the capacity to run a preventive, pollution-focused port state control regime; *section 77* shows that capacity sitting inside the very same statute. It is evidence of a narrower problem: a newly drafted, thoroughly modernised Act, prepared to align Indian law with MARPOL, reproduced the same non-targeted structure; its 1958 predecessor had for the one category of inspection where a targeted structure would matter most. The gap is therefore not in India’s willingness to legislate, but in what each new law is actually asked to fix: a statute can modernise its language and institutions while carrying forward, largely unexamined, the enforcement mechanism that let the previous casualty happen.

MARPOL supplies the discharge standards that this inspection machinery is meant to enforce. Annex One, in force since 1983, regulates the discharge of oil and oily mixtures and requires an oil record book documenting operations involving oily residues, compliance with which depends on adequate shore reception facilities being genuinely available, a dependency examined further in Chapter Five.¹⁹ Annex Four, in force since 2003, prohibits the discharge of untreated sewage except at prescribed distances from land, and Annex Five, in force since 1988, imposes a general prohibition on the discharge of plastics and obliges ports to provide adequate reception facilities for garbage.²⁰ None of these standards enforces itself; each depends on the same port state inspection machinery just discussed to identify non-compliance

¹⁷ Id. s 151.

¹⁸ Id. s 77(2)(b).

¹⁹ Int’l Mar. Org., supra note 6.

²⁰ Id.

before, rather than after, a discharge occurs.

The Ballast Water Management Convention, in force since 2017, requires ships to manage ballast water by exchange or approved treatment before discharge, addressing invasive species transfer, a harm MARPOL does not cover.²¹ Enforcement through port state control is itself still developing regionally: the Indian Ocean Memorandum of Understanding agreed only in 2024 to run a joint concentrated inspection campaign on ballast water with the Paris and Tokyo memoranda for 2025, suggesting coordinated, risk-based ballast water inspection is a recent regional development rather than a mature practice specific to India.²²

Read together, this chapter's analysis suggests that the international framework distributes legal responsibility for ship-generated pollution clearly enough but leaves the question of who actually catches a non-compliant vessel before it causes harm dependent on how individual states choose to build their port state control regimes. India's own newest statute shows that this is a drafting choice rather than a structural inevitability, since the same Act closes exactly this gap for labour standards while leaving it open for pollution. The following chapter examines the remainder of India's domestic legal and institutional architecture against this same question.

Indian Legal and Institutional Framework

Before turning to specific statutes, it is useful to note the constitutional and judicial backdrop against which India's maritime environmental legislation operates. Although the Constitution of India does not expressly mention marine pollution, the Supreme Court has read the right to a healthy environment into the right to life guaranteed by Article 21, and in *Vellore Citizens' Welfare Forum v. Union of India*, the Court held that the precautionary principle and the polluter pays principle form part of the environmental law of the land.²³ It is worth being precise about what that principle actually requires, since it is often invoked as a slogan rather than examined as concrete obligations. In *Vellore Citizens*, the Court directed the constitution of a dedicated authority under *section 3(3) of the Environment (Protection) Act 1986* to assess

²¹ Int'l Mar. Org., *supra* note 10.

²² Indian Ocean Memorandum of Understanding, *supra* note 11.

²³ *Vellore Citizens' Welfare Forum v. Union of India*, AIR 1996 SC 2715, W.P.(C) No. 914 of 1991 (India).

²⁴ Loss of Ecology Authority Directions, *Vellore Citizens' Welfare Forum*, *supra* note 23, at para. 24; see also the Supreme Court's 2025 reaffirmation that this liability is absolute and continuing. ²⁵ The Merchant Shipping Act, *supra* note 3, ss 181–182, 200–201.

ecological damage, determine and recover compensation directly from the polluting industries, and fund restoration, holding that this liability continues until the damage is fully reversed.²⁴ Four elements therefore follow: a designated institutional assessor, direct recovery from the polluter rather than the state, funded ecological restoration, and continuing rather than one-time liability.

Vellore Citizens itself is concerned about untreated effluent from tanneries discharged continuously into the Palar River, a stationary, domestically regulated polluter. Whether its doctrine extends without modification to a one-off marine casualty caused by a foreign-flagged vessel is a genuine doctrinal question, and this paper suggests the answer is qualified. As Chapter Five shows, Indian tribunals have in practice treated ship source spills as falling within the same broad principle, directing the Directorate General of Shipping to fast-track compensation in a manner that echoes the institutional assessment model Vellore Citizens established. But the *Merchant Shipping Act 2025* creates a different liability structure for exactly this situation: Part Nine, Chapter Three, *sections 175 to 195*, and Chapter Four, *sections 196 to 210*, give effect to the international Civil Liability and Bunker Conventions by allowing a shipowner to constitute a limitation fund and cap total liability for oil and bunker pollution damage according to the vessel's tonnage.²⁵ A capped, fund-based liability of this kind sits uneasily beside Vellore Citizens' language of absolute and continuing liability, a tension unresolved in the case law examined here, with the practical result, shown in Chapter Five, that compensation after a marine casualty proceeds through an ad hoc combination of tribunal directions and statutory limitation funds rather than a single settled mechanism.

This uncertainty is compounded by a further, more basic gap. The National Green Tribunal's jurisdiction extends only to civil cases raising a substantial question relating to the environment under the seven enactments listed in Schedule One of the *National Green Tribunal Act 2010: the Water Act 1974, the Water Cess Act 1977, the Forest Conservation*

*Act 1980, the Air Act 1981, the Environment Protection Act 1986, the Public Liability Insurance Act 1991, and the Biological Diversity Act 2002.*²⁴ Neither the 1958 nor the 2025 Merchant Shipping Act appears in that list. This is significant for a paper concerned with ship-generated pollution, because it means the Tribunal's jurisdiction over a marine casualty is

²⁴ The National Green Tribunal Act, No. 19 of 2010, sch. 1, India Code, <https://indiacode.nic.in/handle/123456789/2025> ²⁷The Merchant Shipping Act, supra note 3.

necessarily indirect: it must be framed as a question under the Water Act or the Environment Protection Act, as the Ennore proceedings discussed in Chapter Five were, rather than under the statute that actually regulates vessel discharge, pollution prevention certificates, and detention powers. Should the Merchant Shipping Act be added to Schedule One? The case for inclusion is that it would let the Tribunal exercise jurisdiction over the specific technical scheme, Part Seven's discharge controls, and Part Nine's civil liability chapters, directly. The case against is that Part Nine already imports its own specialised international liability regime, built around limitation funds and flag state coordination, which may not sit comfortably within a tribunal designed around the open-ended compensation powers Schedule One enactments carry. On balance, the more precise reform is not to add the whole Act but to bring Part Seven specifically within the Tribunal's jurisdiction, leaving the civil liability chapters to the limitation fund mechanism the Act already provides. This distinction is returned to in Chapter Seven.

The primary statute governing merchant shipping is now the Merchant Shipping Act 2025, which received presidential assent on 18 August 2025 and, since 15 March 2026, has replaced the Merchant Shipping Act 1958 in its entirety except for a limited saved provision.²⁷ The 2025 Act consolidates a fragmented and outdated 1958 framework of more than five hundred sections into a structure of sixteen parts and three hundred and twenty-five sections. Pollution prevention is addressed specifically in Part Seven, sections 131 to 143, which include the power to control discharge and dumping at sea, the power to deny entry, detain, or move a vessel, and the requirement of valid pollution prevention certificates, while Part Eight, *sections 144 to 152*, governs survey, audit, certification, and the power to conduct inspections.²⁵ As Chapter Three sets out, it is this specific set of provisions, rather than the Act in general, that this paper examines for whether it operates preventively.

Responsibility for implementing the Merchant Shipping Act rests principally with the Director General of Maritime Administration, an office continued from the 1958 Act's Director General of Shipping and supported by Mercantile Marine Departments at major ports.²⁶ The Director General ensures the safety of ships, prevention of marine pollution, and India's compliance with IMO instruments, exercised through flag state inspection, port state control, and oversight

²⁵ The Merchant Shipping Act, *supra* note 3, ss 133, 137, 142, 151.

²⁶ The Merchant Shipping Act, *supra* note 3, ss 7, 11.

of matters connected with MARPOL, including port reception facility adequacy.²⁷

Alongside the shipping-specific framework, India's general environmental legislation applies to the coastal and marine environment. The Environment (Protection) Act 1986 empowers the central government to issue notifications regulating activities in defined areas.²⁸ Under this power, the Ministry of Environment, Forest and Climate Change has issued successive Coastal Regulation Zone notifications since 1991, most recently in 2019, amended more than thirty times since, the great majority loosening rather than tightening restrictions on coastal development, without addressing the implementation gaps the Comptroller and Auditor General's 2022 audit identified, discussed further in Chapter Six.^{29,30}

Water pollution arising from ships and port operations also falls within the *Water (Prevention and Control of Pollution) Act 1974*, which established the Central Pollution Control Board and corresponding State Pollution Control Boards with functions that include setting effluent standards and inspecting sources of pollution.³¹ Its definition of pollution is broad enough to capture ship-sourced discharges into coastal and port waters, and State Pollution Control Boards license the private contractors that operate port waste reception facilities under the arrangements discussed in Chapter Five.

The Biological Diversity Act 2002 provides a further layer of protection insofar as marine species and habitats fall within its scope and, as noted above, sits alongside the Water Act and the Environment Protection Act as one of the Schedule One enactments that ground the National Green Tribunal's jurisdiction.³²

Institutional responsibility for responding to pollution at sea was transferred to the

Indian Coast Guard in March 1986, which has since served as the Central Coordinating Agency

²⁷ Directorate Gen. of Shipping, 'About Us', <https://www.dgshipping.gov.in> (last visited Sept. 8, 2026).

²⁸ The Environment (Protection) Act, No. 29 of 1986, § 3, India Code, <https://indiacode.nic.in/handle/123456789/1876>

²⁹ Ministry of Env't, Forest & Climate Change, Coastal Regulation Zone Notification, G.S.R. 37(E) (Jan. 18, 2019), <https://www.sconline.com/blog/post/2019/01/28/moef-cc-issuance-of-new-coastal-regulation-zone-notification/>; see generally Comptroller & Auditor Gen. of India, *supra* note 2.

³¹ The Water (Prevention and Control of Pollution) Act, No. 6 of 1974, India Code, <https://indiacode.nic.in/handle/123456789/1612>, Central Pollution Control Bd., Mandate, <https://cpcb.nic.in> (last visited Sept. 8, 2026).

³² The Biological Diversity Act, No. 18 of 2003, India Code, <https://indiacode.nic.in/handle/123456789/2046>.

³³ Indian Coast Guard, Press Release, 25th National Oil Spill Disaster Contingency Plan and Preparedness Meeting (Nov. 23, 2023).

for marine oil spill response under the National Oil Spill Disaster Contingency Plan.³³ Under this plan, ports and oil handling agencies are responsible for spills within their own jurisdiction, while the Coast Guard assumes responsibility for spills in India's wider maritime zones, operating dedicated Pollution Response Centres at Mumbai, Chennai, Port Blair and Vadinar.³³

Taken as a whole, India's domestic framework mirrors the layered structure of the international regime described in Chapter Three: does this array of institutions function as a coordinated, preventive system, or as parallel mandates that each perform their assigned function without closing the gaps left by the arrangement they replaced? The next chapter examines the record of implementation to answer that question.

Implementation, Monitoring, Compliance, and Enforcement

The preceding chapters described a legal architecture that, on its face, addresses each of the principal categories of ship-generated pollution and assigns responsibility to identifiable institutions. This chapter tests that architecture against the available record of implementation, drawing on official circulars, audit reports, port state control data and the two documented incidents introduced earlier in this paper.

Compliance with MARPOL's discharge standards under Annexes One, Four and Five depends on adequate shore reception facilities, since a vessel unable to discharge lawfully ashore has a direct incentive to discharge at sea. In 2018, the Directorate mandated that Indian ports and calling vessels use a centralised web-based platform to record ship-generated waste and arrange collection with port-approved vendors.³⁴ In practice, waste reception at Indian ports runs largely through private contractors registered with the relevant State Pollution Control Board, under charges set by individual port authorities, a structure that places compliance on commercial arrangements varying considerably between major ports and India's smaller ports, for which comparable published data is not readily available.³⁵

The 2017 Ennore oil spill illustrates both the operation and the limits of this framework, and its litigation history illustrates the jurisdictional and doctrinal gaps identified in Chapter Four. On 28 January 2017, the tanker BW Maple collided with another tanker, MT Dawn

³³ Oil Spill Contingency Plan, UnderstandUPSC.com (2025).

³⁴ Directorate Gen. of Shipping, Engineering Circular No. 06 of 2018 (Nov. 20, 2018).

³⁵ Kamarajar Port Ltd., Notice on Port Reception Facility Charges (2024).

Kanchipuram, off Kamarajar Port, releasing an estimated 196 metric tons of bunker fuel.³⁶ A peer-reviewed study recorded histological deformities and reduced hemocyte counts in the gills of sampled shore crabs, together with visible oiling of turtles, fish, and seaweed washed ashore in the following days.³⁷

Two applications were filed before the Southern Zonal Bench of the National Green Tribunal at Chennai, framed, consistently with the Schedule One gap identified in Chapter Four, against the National Coastal Zone Management Authority and the pollution control boards rather than under the Merchant Shipping Act itself.³⁸ The Tribunal directed the Director General of Shipping to take charge of and fast-track the compensation process, and the Tamil Nadu Fisheries Department subsequently reported livelihood losses of approximately Rs. 203.22 crore to some one lakh affected fishermen, a figure forwarded to the vessel owners' insurers for settlement.⁴² This is the practical form polluter pays took here: an ad hoc direction to a shipping regulator to coordinate an insurance-backed settlement, rather than the dedicated statutory authority Vellore Citizens contemplated for land-based pollution. A separate suo motu public interest litigation proceeded simultaneously before the Madras High Court, which ordered compensation disbursed within four weeks.³⁹ Two courts exercising overlapping jurisdiction over compensation for the same incident is itself evidence of institutional fragmentation, not coordination.

The emergency response demonstrated that the institutional machinery in Chapter Four could be mobilised quickly, but the ecological assessment came from independent academic researchers rather than routine monitoring, and compensation ran through improvised tribunal directions rather than the fund-based mechanism Part Nine now supplies, pointing to the gap between emergency response capacity and the ongoing, institutionally assigned monitoring contemplated by polluter pays in *the Vellore Citizens' Welfare Forum*.

The sinking of the Liberian-flagged container ship MSC Elsa 3 off the Kerala coast on 25 May 2025 provides a more recent and more revealing test of the preventive question posed in

³⁶ M. Begum et al., Assessment of Ennore Oil Spill 2017 on Chennai Coastal Water and Biota (2022) (IEEE conference paper).

³⁷ Selvakumar et al., supra note 7.

³⁸ *Meenava Thanthai K.R. Selvaraj Kumar Meenavar Nala Sangam v. Chairman, National Coastal Zone Mgmt. Auth.*, Application Nos. 14 & 16 of 2017 (SZ) (Nat'l Green Tribunal, S. Zonal Bench, Chennai). ⁴²Compensation Claims Fast Tracked after Ennore Oil Spill, ICSF (2017).

³⁹ Madras HC Suo Motu PIL on Ennore Oil Spill Compensation, ICSF (2017).

Chapter Three and engages the Act's wreck, casualty response, and civil liability chapters directly. The vessel, en route from Vizhinjam to Kochi, capsized about thirty-eight nautical miles southwest of Kochi, carrying hazardous cargo and hundreds of tonnes of fuel oil.⁴⁰ All twenty-four crew were rescued, the National Oil Spill Disaster Contingency Plan was activated, and Kerala declared the wreck a state-specific disaster, but containers continued washing ashore for weeks afterward.⁴¹

Three sets of provisions in the Merchant Shipping Act 2025 are engaged by a casualty of this kind, worth naming rather than treating the Act as a single backdrop. Part Ten, *sections 223 to 230*, requires a nodal authority for marine incidents empowered to direct the response.⁴² Part Twelve, Chapter One, *sections 233 to 246*, governs wreck, including reporting duties and the owner's liability for removal costs and insurance.⁴³ Part Nine, Chapter Four, *sections 196 to 210*, governs civil liability for bunker oil pollution, again subject to a limitation fund.⁴⁸ None of these chapters is preventive; each operates only once a casualty has occurred, which is precisely why Chapter Three's argument about the absence of risk-based inspection in Part Seven matters. The Act gives India a reasonably complete apparatus for apportioning the cost of a wreck once it happens and a comparatively underdeveloped apparatus for stopping the kind of vessel that becomes one.

The Kerala High Court sought clarity on the extent of the pollution threat, exercising the same kind of judicial supervision seen at Ennore, and a later investigation attributed the casualty partly to poor maintenance on a vessel that, as Chapter Three showed, fell squarely within the age and risk profile the Directorate's own data associates with a materially higher detention rate.⁴⁴ This is the concrete instance of the statutory gap identified in Chapter Three: emergency response, wreck removal, and bunker pollution liability were all activated through the Act's post-casualty chapters, but ordinary port state inspection was not structured to flag this vessel beforehand.

The Coast Guard maintains only four dedicated Pollution Response Centers, at Mumbai,

⁴⁰ MSC ELSA 3 Sinks off Kochi Coast, *supra* note 9.

⁴¹ Kerala Declares MSC ELSA-3 Shipwreck a State Specific Disaster, *supra* note 4.

⁴² The Merchant Shipping Act, *supra* note 3, ss 225–228.

⁴³ *Id.* ss 236, 237, 243–244.

⁴⁸ *Id.* ss 198, 200–201.

⁴⁴ Kerala HC Seeks Clarity on Pollution Risk from MSC Elsa 3 Cargo, Maritime Gateway (2025); Poor Maintenance, Defective Equipment and Crew's Carelessness Caused MSC Elsa 3 Sinking, *supra* note 15.

⁵⁰ Oil Spill Contingency Plan, *supra* note 36; Indian Coast Guard, *supra* note 35.

Chennai, Port Blair, and Vadinar, to cover a coastline of several thousand kilometers, a ratio that becomes significant when a casualty occurs far from any of them, as with the MSC Elsa 3, which sank well south of the Chennai center.⁵⁰ Both case studies illustrate how many distinct authorities must cooperate for an effective response: the Directorate General for port state control, the Coast Guard for at sea response, port authorities and pollution boards for shore-based handling, and the Tribunal or High Courts where litigation follows, a dispersal of function meaning coordination is not guaranteed by any single statute but must be achieved case by case.

Three problems emerge from this record, each examined in full in Chapter Six: port reception facilities are managed through commercial arrangements not subject to comprehensive public reporting; emergency response capacity is concentrated in a small number of Pollution Response Centres relative to the length of India's coastline; and port state control for pollution matters lacks the risk-based targeting mechanism the 2025 Act provides for labour inspections, even though the regulator's own data shows exactly which vessels that targeting would need to catch.

Gaps and Critical Analysis

None of the four gaps below is put forward as a failure peculiar to India's institutions; Chapter Three's comparison between section 77 and Part Seven shows the necessary capacity clearly exists. The argument is narrower: each gap recurs across successive rounds of otherwise genuine legislative modernisation, including the transition from the 1958 to the 2025 Shipping Act and the more than thirty amendments made to the Coastal Regulation Zone notification since 1991, because new instruments tend to modernise institutions, certificates, and language without necessarily building in the specific mechanism that would close the gap the previous instrument left open.⁴⁵

The first gap concerns the reactive character of enforcement. In the Ennore incident, ecological assessment came through an independent academic study, and the pace of clean-up was ultimately supervised through National Green Tribunal proceedings rather than routine administrative monitoring.⁴⁶ In the MSC Elsa 3 incident, judicial inquiry into the pollution risk

⁴⁵ Comptroller & Auditor Gen. of India, *supra* note 2.

⁴⁶ Emergency Oil Spill Recovery Work in Ennore Completed, Tamil Nadu Govt, Deccan Herald (2023).

⁵³ Directorate Gen. of Shipping, Engineering Circular No. 06 of 2018, *supra* note 37.

was prompted by the Kerala High Court after public concern rather than an automatic post-casualty assessment protocol. In both cases, accountability came from academic research or judicial intervention operating alongside, rather than through, the ordinary administrative process.

The second gap is the one this paper documents most precisely: port state control for pollution matters is not put on the same risk-based statutory footing as port state control for labour standards, even within the same, brand new statute. This is not a matter of general institutional weakness; it is a specific, textually identifiable choice in how Part Seven of the Merchant Shipping Act 2025 was drafted relative to *section 77*, set out in full in Chapter Three. Its consequence, illustrated by the MSC Elsa 3, is that a vessel falling within a risk category the regulator's own data already flags can still call routinely at Indian ports without triggering a mandatory targeted inspection.

The third gap concerns the unevenness of port reception facility infrastructure across India's port system. While the reporting platform mandated in 2018 creates a formal mechanism for recording waste disposal, and major ports publish detailed facility information, comparable data for India's minor and intermediate ports is not readily available, and the Directorate's own account of its function describes it as responding to complaints rather than proactively auditing facility adequacy across the system.⁵³

The fourth gap concerns institutional fragmentation, visible in the mismatch between the shipping law framework examined here and the separate body of state fisheries regulation governing mechanised trawlers. Olive Ridley turtle mortality along the Odisha coast, with 6,320 recorded deaths in the 2019 to 2020 nesting season alone arise predominantly from entanglement in trawl nets rather than the categories of ship-generated waste addressed by MARPOL.⁴⁷ This sits outside the ship pollution conventions discussed in Chapter Three, since a trawler is regulated as a fishing vessel under state legislation rather than as a merchant ship, and the turtle is a protected species under the Wildlife (Protection) Act 1972, making its decline a marine wildlife law failure rather than merely a fisheries issue. It remains relevant here because it shows what happens when authorities with mandates drafted independently of one another, *the State Forest Department, the State Fisheries Department, and the Coast Guard,*

⁴⁷ Number of Olive Ridley Turtle Mortality Declines in Odisha this Year, The Tribune (Mar. 18, 2021); *In re News Item Regarding Installation of Transponders*, W.P.(C) No. 7118 of 2021 (Orissa H.C. Mar. 15, 2021) (order) (India).

are each individually responsible for part of the same coastline. The Orissa High Court's own intervention, ordering vessel tracking transponders on mechanised fishing craft, is itself evidence that ordinary administrative enforcement had not achieved what existing rules already required.⁴⁸

Read together, these four gaps indicate that the shortfall in the protection of marine biodiversity from ship-related pollution is not primarily a shortfall in the text of the applicable law, whether international or domestic, and not a matter of any single actor's failure, but a recurring pattern in how new legal instruments are drafted: each closes some gaps while leaving others, often the ones requiring an ongoing institutional mechanism rather than a one-time certificate or penalty, structurally untouched. This finding shapes the recommendations proposed in the following chapter.

Recommendations

The following recommendations correspond directly to the four gaps identified in Chapter Six. None requires a new convention or a further wholesale rewriting of Indian legislation; the aim is to close the specific mechanism gap that each successive reform has so far carried forward rather than to add another round of general modernisation.

First, this paper does not recommend creating a new monitoring power, because one already exists and is simply not used for this purpose. Section 140 of the Merchant Shipping Act 2025 already gives the Central Government power to take measures for the detection of pollution, and *section 141* already provides for the appointment of analysts.⁵⁶ What is missing? is its conversion into a transparent, biodiversity-sensitive, post-casualty protocol: a rule made under section 143 should require that, after any significant casualty, the section 140 power be exercised on a fixed timeline by a named agency, logically the Indian Coast Guard with the National Centre for Sustainable Coastal Management, that findings be published rather than held internally, and that assessments proceed against defined ecological indicators, such as those the Ennore histological study used, rather than a generic checklist. This would ensure findings of the kind produced independently after Ennore are generated by the existing power as a matter of course and supply the evidentiary basis for compensation claims founded on the

⁴⁸ *In re News Item Regarding Installation of Transponders*, supra note 54.

⁵⁶ The Merchant Shipping Act, supra note 3, ss 140–141.

polluter pays principle.⁴⁹

Second, consistently with Chapter Four, Parliament should amend Schedule One of the National Green Tribunal Act 2010 to bring Part Seven, the pollution prevention and detection provisions, within the Tribunal's jurisdiction, without extending that inclusion to Part Nine's specialised civil liability chapters, which should remain administered through their own limitation fund mechanism. This would let a future Ennore or MSC Elsa 3 proceeding be brought directly under the statute that actually regulates vessel discharge and detection, rather than framed under the Water Act or the Environment Protection Act, as the 2017 applications had to be.⁵⁰

Third, and most directly responsive to the analysis in Chapter Three, *section 77(2)(b) of the Merchant Shipping Act 2025*, which requires a risk-profiled electronic inspection database for port state labour inspections, should be extended by rule-making under Part Seven to pollution prevention inspections as well. This would not require new primary legislation, since section 143 already empowers the Central Government to make rules for the purposes of Part Seven; it requires only that the risk profiling mechanism Parliament has already enacted for one purpose be applied to the purpose, pollution prevention, for which the Directorate's own data shows it is most needed.⁵⁹

Fourth, the existing waste reporting platform should be converted from a complaint-driven mechanism into a system of periodic, published audits of reception facility adequacy at all major and intermediate ports so that gaps are visible before they contribute to unlawful at sea discharge.

Fifth, in response to institutional fragmentation, coordination between the Directorate General, the Coast Guard, and State Fisheries and Forest Departments should be formalised through a joint patrol and licensing protocol linking trawler licence renewal to verified turtle excluder device use and vessel tracking, of the kind already ordered by the Orissa High Court.⁵¹

Each of these measures is designed to be implemented within, or as a rule made under, the framework Parliament has already enacted, precisely because the pattern this paper identifies

⁴⁹ *Vellore Citizens' Welfare Forum*, supra note 23.

⁵⁰ *Meenava Thanthai K.R. Selvaraj Kumar Meenavar Nala Sangam*, supra note 41.

⁵⁹ *The Merchant Shipping Act*, supra note 3, s 143.

⁵¹ *In re News Item Regarding Installation of Transponders*, supra note 54.

is not a shortage of legislative will but a tendency for successive reforms to leave a specific mechanism gap in place while modernising everything around it.

Conclusion

This paper has examined whether India's legal and regulatory architecture adequately protects marine biodiversity from ship-generated pollution, with particular attention to the preventive capacity of port state control. The analysis indicates that India possesses a substantial body of international and domestic obligations, but that important implementation mechanisms remain unevenly developed. The transition from the Merchant Shipping Act 1958 to the Merchant Shipping Act 2025 modernised the statutory framework and introduced detailed provisions on pollution prevention, inspection, casualty response, and liability. Nevertheless, the Act does not expressly extend the risk-profiled inspection approach found in section 77 to pollution-prevention inspections under Part Seven. This creates a specific regulatory gap that is narrower, and more readily addressable, than a general claim that India lacks adequate marine-pollution law.

The Ennore oil spill and the MSC Elsa 3 casualty demonstrate the importance of this distinction. Both incidents show the capacity of Indian institutions to mobilise after a marine casualty, but they also expose the limits of relying primarily on post-casualty response, judicial supervision, and ad hoc ecological assessment. The Elsa 3 evidence does not establish that a risk-based inspection would necessarily have prevented the casualty; it does, however, support the case for a preventive system capable of directing greater scrutiny towards vessels displaying identifiable risk characteristics. The Olive Ridley example is treated separately as evidence of institutional fragmentation between shipping, fisheries, and wildlife governance rather than as a direct MARPOL compliance failure.

The paper therefore recommends targeted rather than wholesale legal reform: use the existing rule-making powers under the Merchant Shipping Act 2025 to develop risk-based pollution inspections and transparent post-casualty ecological assessment; improve public reporting on port reception facilities unless future legislative and regulatory reforms address the preventive mechanisms identified in this paper.