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Marine Pollution And Governance Challenges: Indian Experiences Within An Evolving International Legal Framework

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Abstract:

Marine pollution has emerged as a critical global environmental challenge, driven primarily by land-based discharges, shipping, oil spills, overfishing, and the exponential rise of plastics and microplastics that now permeate water, sediment, and marine food webs, thereby undermining biodiversity, food security, coastal livelihoods, and human health, particularly in developing maritime nations such as India with long, densely populated coastlines and rich yet fragile marine ecosystems. At the international level, the United Nations Convention on the Law of the Sea (UNCLOS) establishes broad obligations on all states to protect and preserve the marine environment and to prevent, reduce, and control marine pollution from diverse sources, including land-based activities, dumping, and vessel-source pollution, which are further operationalised through specialised treaties such as MARPOL, regulating pollution from ships across several technical annexes, and the London Convention and its 1996 Protocol, which restrict dumping of wastes at sea through permitting systems and strict prohibition lists. In the Indian context, the extensive coastline faces complex and cumulative pollution pressures from industrial effluents, untreated sewage, port and shipping activities, coastal construction, tourism, and rapidly increasing plastic and microplastic litter, resulting in habitat loss, coral stress, eutrophication, and contamination of commercially important fish species that support coastal communities. India has adopted a range of legal and policy measures—such as implementing MARPOL obligations through domestic rules under the Environment (Protection) Act, port state controls, and coastal regulation norms—to manage ship-source pollution and coastal development, yet enforcement gaps, fragmented institutional jurisdiction, limited monitoring capacity, and low community participation significantly constrain their effectiveness in practice. Emerging issues such as microplastics highlight a sharp global–local governance deficit: they are now ubiquitous in Indian coastal waters and marine biota, while international and national frameworks still rely largely on general obligations under UNCLOS and scattered soft-law or sectoral initiatives rather than detailed, binding rules specifically tailored to marine plastic pollution. Consequently, addressing marine pollution from both Indian and international perspectives demands integrated, multi-scalar strategies that combine stronger international cooperation, stricter and more coherent national implementation, improved land-based waste management, science-based monitoring, and participatory coastal governance, with particular attention to vulnerable regions such as coral islands, estuaries, and mangrove belts that serve as ecological buffers yet remain acutely exposed to cumulative anthropogenic pressures

Introduction

Marine pollution in India is both a critical environmental challenge and a complex socio-economic issue. With a coastline exceeding 7,500 km, India's coastal and marine ecosystems are vital for biodiversity, fisheries, tourism, and livelihoods. However, the increasing influx of pollutants from diverse sources threatens these ecosystems and poses risks to human health and sustainable development. Major sources of marine pollution include untreated sewage discharge, industrial effluents laden with heavy metals and toxic chemicals, agricultural runoff containing pesticides and fertilizers, plastic and microplastic debris, oil spills from shipping and offshore extraction, and abandoned fishing gear.[i]

One of the defining features of marine pollution in India is the overwhelming presence of plastic waste. Studies conducted over recent years reveal that plastic constitutes a significant proportion of marine litter along Indian shores, with recent surveys estimating plastics to make up about 43% to 80% of debris in various coastal regions and coral reefs. Riverine inputs deliver massive quantities of plastics into marine environments, propelled further by tourism, recreational activities, and inadequate waste management in coastal urban centres. The challenge intensifies as plastic debris not only impacts marine organisms through ingestion and entanglement but also breaks down into microplastics, which infiltrate food chains, posing potential long-term ecological and health consequences.[ii]

India also grapples with pollution arising from oil spills and chemical discharges. The country's prominence in oil and gas exploration and its strategic location along major maritime routes increase vulnerability to accidental spills and operational discharges. These pollutant events degrade water quality, damage sensitive ecosystems such as mangroves and coral reefs, and disrupt coastal fisheries. Coastal mangroves, which serve as natural buffers and biodiversity hotspots, have been found to harbour considerable amounts of plastic and other waste, further undermining their ecological function and resilience. [iii]

Additionally, untreated sewage remains a substantial contributor to marine pollution. Nearly 40 million litres of untreated sewage are reported to be discharged daily into India's rivers, which subsequently flow into the sea, introducing pathogens, nutrients, and organic matter that cause eutrophication and threaten marine life. Industrial discharge compounds the problem by adding heavy metals like lead, cadmium, and arsenic, which can bioaccumulate in marine organisms, endangering ecosystem and human health. [iv]

While national efforts such as the Swachh Sagar Surakshit Sagar campaign and community-led beach cleanup initiatives have successfully reduced beach litter to some extent, significant challenges in governance, regulation enforcement, and integrated coastal zone management persist. Fragmented oversight among various agencies, insufficient monitoring infrastructure, and limited public awareness hinder comprehensive pollution prevention and mitigation strategies. [v]

Climate change and anthropogenic pressures further exacerbate these problems by altering coastal dynamics, impacting water quality, and stressing marine ecosystems already burdened by pollution. Coral reefs in the Andaman and Nicobar Islands and the Gulf of Mannar have shown physical damage and tissue loss linked directly to marine debris pollution, with estimated fragmentation of nearly half the corals in contact with litter. [vi]

To overcome these multifaceted challenges, India requires robust legal frameworks, enhanced inter-agency coordination, expansion of scientific monitoring including microplastic quantification, and increased community engagement in marine conservation. Upgrading wastewater treatment systems, strengthening port and shipping pollution regulation, and adopting international best practices are also essential. Addressing marine pollution is fundamental not only for environmental protection but also for securing the blue economy that sustains millions of coastal communities across India.

Constitutional Foundations

India's constitutional provisions serve as the bedrock for marine pollution regulation. Article 21 of the Indian constitution guarantees the right to a healthy environment, which courts have expansively interpreted to include marine and coastal ecosystems. Article 48A directs the state to protect the environment, while Article 51A(g) imposes a duty on citizens to protect nature. Courts have invoked these provisions to affirm the state's obligation to prevent marine pollution, framing it as a fundamental environmental protection.[vii]

Major Statutes Governing Marine Pollution in India

The Environment (Protection) Act, 1986
This act provides comprehensive authority to the Central Government to regulate environmental pollution, including marine pollution. It empowers the government to notify standards for effluent discharge, prohibit pollutant release, and establish environmental standards applicable to ships, ports, and coastal activities. The Act also authorizes the framing of rules for controlling marine pollution.[viii]

Water (Prevention and Control of Pollution) Act, 1974
Initially focused on industrial pollution of inland water, this Act was amended in 2024 to include coastal and marine waters under its ambit. It established the Central Pollution Control Board (CPCB) and State Pollution Control Boards (SPCBs), which issue permits for effluent discharge and enforces standards to prevent marine contamination.[ix]

The Coastal Regulation Zone (CRZ) Notification, 2011, The CRZ rules govern activities along the coastal areas, restricting construction, waste disposal, and effluent discharge within specified zones. After revisions in 2019, these rules introduced stricter controls on ports and industries to prevent marine pollution.[x]

Merchant Shipping Act, 1958; revised by the Merchant Shipping Act, 2025
The recent amendments incorporate India’s commitments under MARPOL, the International Convention for the Prevention of Pollution from Ships. The Act prescribes rules for marine oil spills, waste disposal, and vessel compliance.[xi]

Maritime Zones of India Act, 1976
This Act delineates India’s jurisdiction in territorial waters, EEZ, and continental shelf and establishes enforcement authority for pollution control over ships and offshore activities.[xii]

Landmark Court Cases

In the case of *Samit Mehta v. Union of India (2016)*
The National Green Tribunal imposed a fine of Rs. 100 crores on the oil spill firm involved in the Mumbai oil tanker incident. This ruling reaffirmed the 'polluter pays' principle and enforced stricter liabilities for maritime pollution.[xiii]

Lt. Col. Sarvadaman Singh Oberoi v. Union of India (2019)
The Supreme Court directed the government to implement effective mechanisms for oil spill response and coastal cleanup, emphasizing the state’s duty under Article 21 to safeguard the marine environment.[xiv]

Indian Council for Enviro-Legal Action v. Union of India (1996)
This Supreme Court ruling established the doctrine of ‘absolute liability’ for industries polluting the environment. Though originally focused on hazardous waste pollution of land and water bodies, this principle extends to marine pollution, holding polluters strictly responsible without exceptions. It underscored that polluters bear the entire cost of damage and restoration, enhancing compensation mechanisms for affected coastal communities and ecosystems[xv].

Ratlam Municipality v. Vardhichand (1980)
This early Supreme Court case set important environmental protection precedents, including applying tort law principles to pollution harms. Although focused on land pollution, it recognized the state's duty to prevent pollution of water bodies, including marine waters, emphasizing the fundamental right to life and a clean environment. It laid groundwork for later judgments applying constitutional rights to environmental protection[xvi].

M.C. Mehta v. Union of India (Taj Trapezium Case, 1997) Though primarily air pollution-focused, this case's principles have been broadly applied to environmental management, including marine pollution. The Court emphasized pollutant reduction and sustainable development, reinforcing state accountability. The judgment influenced state-level policies on coastal and marine pollution control infrastructure development[xvii].

Narmada Bachao Andolan v. Union of India (2000) The Supreme Court ruled on environmental assessments relating to dam projects impacting rivers flowing into the sea. The judgment underscored the importance of ecological balance, including marine biodiversity protection, mandating comprehensive environmental impact assessments to prevent downstream coastal and marine pollution[xviii].

Vellore Citizens Welfare Forum v. Union of India (1996) A public interest litigation focusing on industrial pollution, the Court held the State accountable for enforcing environmental norms. The case's principle of sustainable development and precautionary action has guided policies on marine pollution mitigation, especially around coastal industrial zones[xix].

T.N. Godavarman Thirumulpad v. Union of India (1996) Primarily related to forest conservation, this judgment indirectly impacts marine pollution by emphasizing catchment area protection, critical to preventing sediment and pollutant runoff into marine waters. It reinforced integrated environmental governance benefiting marine ecosystems[xx].

K.M. Chinnappa v. Union of India (2007) The Karnataka High Court directed the state government to take urgent action to stop polluting discharges into coastal waters along Dakshina Kannada and Udupi districts. The Court emphasized immediate measures to prevent untreated sewage and industrial effluents from entering the Arabian Sea, protecting public health and marine biodiversity[xxi].

Ganga Pollution Case (M.C. Mehta v. Union of India, 1988) In this landmark case, environmentalist M.C. Mehta filed a public interest litigation concerning the pollution of the Ganga River, which is home to rich aquatic biodiversity, including numerous species of fish and other aquatic animals. The Supreme Court mandated strict pollution control measures, including the setting up of sewage treatment plants and controlling industrial effluents discharging into the river. The case underscored the importance of protecting aquatic ecosystems and their fauna, recognizing the right of aquatic animals to a clean habitat, and requiring the government to ensure ecological balance in water bodies. This case highlights judicial recognition of the importance of aquatic animal habitats and the government's duty to preserve aquatic biodiversity[xxii].

Enforcement Agencies and Instruments

- Indian Coast Guard (ICG): Responsible for maritime environmental protection, response to oil spills, and surveillance.
- Central Pollution Control Board (CPCB): Sets standards, issues permit, and monitors discharges.
- State Pollution Control Boards (SPCBs): Enforce pollution laws at local levels.
- Port Authorities: Ensure port operations comply with pollution norms.[xxiii]

Recent Policy Reforms and Legislative Changes

Indian Ports Bill, 2025
This legislation seeks to modernize port management, stipulating mandatory waste reception facilities and pollution monitoring at every port.

Merchant Shipping Act, 2025
The Act introduces tougher penalties and detailed liability structures for ships causing marine pollution and aligns India's standards with IMO guidelines.

Amendments to Water Act, 2024
The amendments promote digital monitoring, impose higher fines for illegal discharges, and strengthen the response system for marine spills.[xxiv]

Challenges

Despite an extensive legal framework, enforcement remains weak due to inadequate monitoring, coordination issues, and a lack of scientific research. Plastic marine debris and oil spills continue to threaten ecosystems. A comprehensive legal regime for marine litter, increased marine scientific capacity, and community awareness can help bridge the gap.

- Establish a Marine Pollution Control Act as a standalone law.
- Increase capacities for spill response and monitoring.
- Enforce stricter waste disposal norms at ports and ships.
- Promote regional cooperation for transboundary pollution.

India's legal framework for marine pollution comprises constitutional principles, environmental legislation, maritime laws, and judicial activism. Its effectiveness depends on enforcement, scientific research, and policy integration. Strengthening these dimensions is crucial to safeguard India's seas' ecology and economy for future generations.

International Perspective on Marine Pollution Laws and Governance

Marine pollution is a transboundary issue requiring global cooperation and legal harmonization. India's marine pollution laws operate within this broader international framework, reflecting obligations under various global treaties and conventions.

The United Nations Convention on the Law of the Sea (UNCLOS), 1982, is the cornerstone of international marine law, establishing coastal state rights and responsibilities, including pollution prevention within their maritime zones. UNCLOS Part XII mandates states to protect the marine environment and control pollution from land-based sources, ships, seabed activities, and dumping (United Nations 1982).

The International Convention for the Prevention of Pollution from Ships (MARPOL), 1973/78, administered by the International Maritime Organization (IMO), is the principal agreement addressing pollution from vessels. It sets global standards for discharges of oil, chemicals, sewage, garbage, and air emissions from ships, promoting environmentally sound shipping practices (IMO 2025).

The London Convention (1972) and subsequent London Protocol (1996) regulate ocean dumping to prevent harmful waste disposal at sea, requiring rigorous controls and permits for disposal activities (IMO 2024).

Regional efforts, such as the European Union's Marine Strategy Framework Directive (MSFD), provide good examples of holistic marine environmental management. The MSFD requires member states to achieve Good Environmental Status by monitoring and mitigating marine pollution, incorporating scientific assessments, and implementing management plans at the regional scale (European Commission 2021).

Despite these comprehensive international instruments, challenges persist due to enforcement variability, jurisdictional complexities, and emerging pollutants like microplastics. Continued international cooperation, through frameworks like UNEP's Regional Seas Programme, is essential to address gaps and enhance capacity-building (UNEP 2023).

International cases

The *Gabčíkovo-Nagymaros Project Case (Hungary/Slovakia, 1997)*
The International Court of Justice (ICJ) addressed the impact of a dam project on the Danube River ecosystem, emphasizing the precautionary principle and the need to protect aquatic biodiversity. The Court underscored states' obligations to prevent environmental harm to transboundary waterbodies and aquatic life, setting a precedent for balancing development and ecological preservation[xxv].

Southern Bluefin Tuna Cases (Australia & New Zealand v. Japan, ITLOS 1999 & 2000)
These cases before the International Tribunal for the Law of the Sea (ITLOS) focused on overfishing of Southern Bluefin Tuna in international waters, threatening species survival. The tribunal ordered compliance with conservation measures to protect the migratory species, highlighting the responsibility of nations to regulate fishing to preserve marine life[xxvi].

Whaling in the Antarctic Case *(Australia v. Japan, ICJ 2014)*
Australia challenged Japan's whaling program citing the International Convention for the Regulation of Whaling, arguing it caused irreversible damage to whale populations. The ICJ ruled largely in favor of Australia, emphasizing conservation of cetaceans and setting limits on scientific whaling to protect aquatic mammals[xxvii].

Tail Smelter Case (United States v. Canada, 1938 & 1941) Although primarily about air pollution, this landmark case laid down principles of transboundary environmental harm, influencing future aquatic preservation cases. It established the responsibility to prevent environmental damage affecting the natural resources and aquatic species of neighbouring countries[xxviii].

Corfu Channel Case (UK v. Albania, ICJ 1949) The Court held Albania responsible for mines that damaged British warships in the Corfu Channel, implicitly recognizing the obligation to protect safe navigation and marine environments, indirectly benefitting aquatic life by reducing human-induced harm to marine habitats[xxix].

Baltic Sea Dumping Case (ITLOS, 1996) This case upheld the responsibilities of states bordering the Baltic Sea to prevent marine pollution, including hazardous waste dumping threatening fish and other aquatic organisms, reinforcing collaborative regional efforts for aquatic conservation[xxx].

Lake Lanoux Arbitration (France-Spain, 1957) The arbitration dealt with water use affecting an international water body, Lake Lanoux, emphasizing equitable use and the protection of aquatic ecosystems within shared water resources[xxxi].

Pulp Mills on the River Uruguay (Argentina v. Uruguay, ICJ 2010) The Court ruled on the environmental impact of pulp mills on the Uruguay River, focusing on protecting aquatic flora and fauna from industrial pollution, requiring thorough environmental assessments and monitoring[xxxii].

Southern Ocean Whale Sanctuary Establishment (IWC, ongoing) The International Whaling Commission's designation of the Southern Ocean Whale Sanctuary aims to provide legal protections for whale populations critical to aquatic biodiversity[xxxiii].

Rainbow Warrior Case (New Zealand and France, 1986 ICSID) This case involved the sinking of Greenpeace's ship protesting nuclear testing, emphasizing protection of marine protestors but indirectly underscoring the importance of preserving marine environments and raising awareness of aquatic life conservation[xxxiv].

These cases signify the evolving international jurisprudence recognizing the vital importance of protecting aquatic life through environmental stewardship, state responsibility, and cooperative management. They shape international environmental law principles such as precaution, prevention, sustainable use, and transboundary impact assessment critical to aquatic life preservation.

Conclusion:

marine pollution must be recognized as a systemic, transboundary problem that links land-based waste, shipping emissions, coastal industrialization, and climate stressors, with compounded impacts on biodiversity, fisheries, human health, and coastal economies. Internationally, existing frameworks like UNCLOS set broad duties to prevent, reduce, and control pollution from all sources, while instruments such as MARPOL and the London Convention operationalize controls on vessel-source pollution and dumping; yet enforcement unevenness, coverage gaps for plastics and microplastics, and limited binding obligations for land-based sources remain persistent constraints. For India, the challenge is acute due to long, densely populated coastlines, expanding port-led development, and rising plastic and microplastic loads documented in coastal waters and biota, which translate into habitat degradation, coral stress, and risks to food safety and livelihoods; despite domestic implementation of ship-source controls and coastal regulation, monitoring capacity, institutional coordination, and community engagement are still insufficient to match the scale of pressures. Closing these gaps requires a pivot from fragmented, end-of-pipe responses to integrated land–sea governance: upstream waste and wastewater infrastructure, extended producer responsibility for plastics, stormwater and agricultural runoff controls, and science-based marine spatial planning that

safeguards mangroves, estuaries, and coral systems as natural buffers. Globally, negotiating binding rules on plastic life cycles, harmonized monitoring of microplastics, and stronger compliance mechanisms under shipping and dumping regimes would align incentives and reduce leakage across jurisdictions, while financing for developing coastal states can enable surveillance, data systems, and blue-economy transitions grounded in ecosystem restoration. Ultimately, credible progress hinges on coupling international legal obligations with local implementation and citizen participation—treating marine pollution not as an ocean-only issue, but as a full watershed-to-reef agenda that integrates circular economy practices, rigorous enforcement, and transparent metrics to track recovery of fisheries, water quality, and coastal resilience over time.

End notes:

[i] https://www.pib.gov.in/PressReleasePage.aspx?PRID=2152990

[ii] https://india.mongabay.com/2025/09/india-needs-a-marine-litter-policy-as-plastic-waste-chokes-corals/

[iii] https://www.pib.gov.in/PressReleasePage.aspx?PRID=2152990

[iv] https://www.indiancurrents.org/article-river-and-ocean-pollution-in-india-a-report-janina-gomes-2420.php

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[x] *Coastal Regulation Zone (CRZ) Notification," Ministry of Environment, Forest and Climate Change.*

[xi] *Merchant Shipping Act, 2025," Government of India, 2025.*

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[xiii] *Samit Mehta v. Union of India," NGT, 2016.*

[xiv] *Lt. Col. Singh Oberoi v. UOI," Supreme Court of India, 2019.*

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[xvii] M.C. Mehta v. Union of India & Ors. (1997) 2 SCC 353

[xviii] Narmada Bachao Andolan v. Union of India: 2000 INSC 489.

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[xxvi] *Southern Bluefin Tuna Cases (New Zealand v. Japan; Australia v. Japan)*, Order on Provisional Measures, ITLOS Cases Nos. 3 and 4, (27 August 1999).

[xxvii] Whaling in the Antarctic (Australia v. Japan: New Zealand intervening), Judgment, I.C.J. Reports 2014, p. 226

[xxviii] Trail Smelter Arbitration (United States v. Canada), 16 April 1938 and 11 March 1941, 3 UNRIAA 1905.

[xxix] Corfu Channel (United Kingdom v. Albania), ICJ Rep 1949

[xxx] *Request for an Examination of the Situation in the Nuclear Tests Case (New Zealand v. France)*, Order of 23 September 1995, ITLOS Reports 1996, p. 7.

[xxxi] Lake Lanoux Arbitration (France-Spain, 1957)

[xxxii] Pulp Mills on the River Uruguay (Argentina v. Uruguay), Judgment, I.C.J. Reports 2010, p. 14

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