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Environmental Law Study on Asphalt Pollution Cases in the Nias Sea and Its Enforcement

Article

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Abstract

Objective: This study aims to examine the legal framework and enforcement mechanisms governing marine pollution caused by asphalt spills, focusing on the MT AASHI case in the Nias Sea. It seeks to assess the effectiveness of Indonesia's environmental law in ensuring accountability and ecological justice in marine pollution cases.

Theoretical Framework: This research is grounded in environmental law principles, particularly the polluter pays principle, strict liability, and the precautionary principle, combined with theories of legal responsibility and ecological justice to evaluate the adequacy of normative legal protection.

Method: This study employs normative juridical (doctrinal) legal research using statute, conceptual, and case approaches. Legal materials consist of primary sources (legislation and international conventions), secondary sources (legal doctrines and scholarly works), and tertiary sources.

Results and Discussion: The findings reveal that although Indonesia has a comprehensive regulatory framework for marine environmental protection, its enforcement remains ineffective. The application of strict liability is not fully optimized, inter-agency coordination is fragmented, and law enforcement tends to rely on administrative measures rather than civil and criminal sanctions. This condition weakens deterrence and undermines ecological justice for affected communities.

Research Implications: This study highlights the need for strengthening institutional coordination, enhancing science-based evidence in environmental litigation, and reformulating enforcement mechanisms to ensure the effective application of environmental law principles in marine pollution cases.

Originality/Value: This research offers a specific legal analysis of asphalt pollution—an underexplored issue in Indonesian environmental law—and proposes a normative reconstruction of marine environmental law enforcement that integrates strict liability with a more effective and justice-oriented accountability system.

Keywords: *absolute liability; ecological justice; environmental law; law enforcement; marine pollution.*

INTRODUCTION

Marine pollution is an environmental issue that continues to be a concern in Indonesia. As an archipelagic nation with a large portion of its territory covered by ocean, Indonesia relies heavily on marine ecosystems to support its people's lives, particularly in coastal areas. The sea is not only a source of livelihood for fishermen but also plays a vital role in maintaining ecological balance and environmental sustainability. However, in reality, the sea is often the victim of irresponsible human activities. One concrete form of marine ecosystem destruction is pollution from spills of hazardous materials such as oil or asphalt. The recent case in the waters of Nias, North Sumatra, is a concrete example of the weak oversight and law enforcement of shipping activities and the transportation of hazardous materials in Indonesian waters[1].

This marine pollution case began with an incident involving a crude asphalt spill from the MT AASHI tanker, which sprang a leak in the waters off Nias. According to information from the Ministry of Maritime Affairs and Fisheries (KKP), the asphalt spill caused a thick, black layer to spread across the sea surface, polluting coastal areas. This incident has had serious impacts on the marine environment and the lives of surrounding communities, especially fishermen who depend on their catch for their livelihood[2]. This type of pollution not only harms marine ecosystems but also violates the community's right to a clean and healthy environment, as guaranteed by Law No. 32 of 2009 concerning Environmental Protection and Management. Therefore, this case is crucial to examine from an environmental law perspective, to determine the extent to which the implementation of existing regulations can provide a deterrent effect and ensure ecological justice for the community and environmental sustainability.

Although regulations on marine environmental protection are quite comprehensive, ranging from Law No. 32 of 2014 concerning Maritime Affairs to its derivative regulations on pollution prevention and control, in practice, law enforcement is often suboptimal. Many marine pollution cases end without clear accountability, whether administrative, civil, or criminal. Furthermore, legal proceedings against corporations that own ships or transport companies carrying hazardous materials still encounter various obstacles, particularly in proving and enforcing the principle of strict liability. This situation underscores the need for a more in-depth study of how environmental law in Indonesia operates in marine pollution cases such as the one in the Nias Sea[3].

Academically, this research is also interesting because there are not many legal studies that specifically discuss marine pollution caused by raw asphalt spills, considering that most previous research has focused more on oil pollution or industrial waste. However, asphalt has characteristics that are no less dangerous because it is difficult to decompose and can cause long-term damage to marine biota. Using normative legal research methods, this article will discuss the legal basis, the responsibility of the ship, and the form of law enforcement carried out by the government in the MT AASHI case. Furthermore, this research also aims to assess

[1] Mayya Saliba, Sofia Frantzi, and Pieter van Beukering, "Shipping Spills and Plastic Pollution: A Review of Maritime Governance in the North Sea," *Marine Pollution Bulletin* 181, no. March (2022): 113939, https://doi.org/10.1016/j.marpolbul.2022.113939.

[2] Svitlana Liubartseva et al., "Model-Based Insights into Pathways and Fate of Oil Spills in the Mediterranean Sea," *Marine Pollution Bulletin* 217, no. January (2025): 118061, https://doi.org/10.1016/j.marpolbul.2025.118061.

[3] Liubartseva et al.

the effectiveness of the application of environmental law principles, such as the polluter pays principle and the precautionary principle, in dealing with pollution cases in Indonesian waters[4].

This study hopes to provide a clearer picture of how environmental law should be enforced in marine pollution cases, as well as how government and law enforcement efforts can be improved to prevent similar cases from recurring in the future. This research is also expected to make a tangible contribution to the development of environmental law in Indonesia, particularly in the context of protecting marine ecosystems, which are a vital component of the sustainability of national natural resources.

RESEARCH METHODS

This research uses a normative juridical method, often referred to as doctrinal legal research. This method focuses on the study of applicable positive legal norms, including laws, government regulations, and ministerial regulations related to environmental protection and management, particularly regarding marine pollution. This approach was chosen because the problem being studied is normative legal in nature, namely examining how existing legal provisions are applied in the case of asphalt pollution in the Nias Sea due to the grounding of the MT AASHI ship.

In this normative research, the legal materials used consist of primary legal materials, secondary legal materials, and tertiary legal materials. Primary legal materials include relevant laws and regulations such as Law Number 32 of 2009 concerning Environmental Protection and Management, Law Number 32 of 2014 concerning Maritime Affairs, Law Number 27 of 2007 in conjunction with Law Number 1 of 2014 concerning Management of Coastal Areas and Small Islands, as well as various implementing regulations such as Regulation of the Minister of Maritime Affairs and Fisheries Number 26 of 2021 and Presidential Regulation Number 109 of 2006 concerning Emergency Response to Oil Spills at Sea[5].

Meanwhile, secondary legal materials were obtained from various literature, scientific journals, textbooks, research results, and official news relevant to the topics of marine pollution, environmental law, and corporate responsibility for environmental damage. One important secondary material in this research is the official press release of the Ministry of Maritime Affairs and Fisheries (KKP), which explains the chronology and steps in handling the MT AASHI case in Nias waters. Meanwhile, tertiary legal materials were used as supplements, in the form of legal dictionaries, legal encyclopedias, and other supporting documents to strengthen understanding of environmental law terms and concepts.

The approaches used in this research include the statute approach, the conceptual approach, and the case approach[6]. The legislative approach is conducted by examining various legal provisions governing the prevention and control of marine pollution. The conceptual approach is used to understand environmental legal principles such as the polluter pays principle, the precautionary principle, and strict liability, which form the basis for law enforcement in pollution cases. The case-based approach is conducted by analyzing the legal

[4] Roberto Octavinus Cornelis Seba, "Implementation of the Strict Liability Principle in Combating Marine Pollution in North Nias Sea," *Nakhoda: Jurnal Ilmu Pemerintahan* 24, no. 1 (2025): 1–16, https://doi.org/10.35967/njip.v24i1.807.

[5] Nilawati Yuddin, Wiwik Sri Widiarty, and Aartje Tehupeiori, "Pertanggung Jawaban Perusahaan Pemilik Kapal Terhadap Kasus Pencemaran Lingkungan Sebagai Akibat Tumpahaan Minyak Muatan Kapal Laut Di Indonesia," *Syntax Idea* 5, no. 12 (2023), https://doi.org/10.46799/syntax-idea.v5i12.2650.

[6] Fitri Kurnianingsih, Syafrianita Syafrianita, and Armauliza Septiawan, "Public Management Model in Marine Pollution Control ; A Case Study of Bintan Regency," 2025, 89–99.

facts of the asphalt spill incident in the Nias Sea based on available official data and information.

All legal materials were then analyzed using descriptive-analytical techniques, describing the applicable regulations and analyzing their application in concrete cases. This analysis aims to assess the extent to which environmental legal provisions in Indonesia are able to protect the marine environment and ensure the accountability of parties causing pollution. The research results are expected to provide a more comprehensive understanding of the effectiveness of environmental law enforcement in the context of marine pollution and provide recommendations for future policy improvements[7].

ANALYSIS AND DISCUSSION

1. Chronology and Environmental Impact of the Asphalt Pollution Case in the Nias Sea

The asphalt pollution case in the Nias Sea, which occurred due to the grounding of the MT AASHI tanker, is a serious incident that reflects the weakness of the environmental monitoring and law enforcement system in Indonesia, particularly in the maritime sector. This incident not only caused significant ecological losses but also exposed a lack of coordination among state institutions in addressing marine pollution. The sea, a source of life for coastal communities, has been transformed into a site of hazardous material pollution that can threaten the ecosystem and the livelihoods of local residents. This case also raises the urgency to further examine the effectiveness of environmental law enforcement, particularly in the context of enforcing the principle of strict liability for perpetrators of marine pollution[8].

The asphalt spill from the MT AASHI vessel attracted public attention after being widely reported by the media. The tanker, carrying a large cargo of asphalt, sprang a leak in the waters off Nias, causing the asphalt to spill into the sea, which continued for several days. The heavy and viscous asphalt material caused a thick, black layer to cover the surface of the sea and blanket the beaches around the incident site. The impact was felt directly on marine life, especially fish and coral reefs, which are the main pillars of the ecosystem in the area. From a legal perspective, this incident demonstrates how the implementation of Law Number 32 of 2009 concerning Environmental Protection and Management (PPLH) still faces serious challenges in its implementation, particularly when dealing with shipping activities and the oil or chemical industry at sea[9].

1.1 Chronology of the MT AASHI Shipwreck

The tanker MT AASHI reportedly experienced a leak while transiting the waters off Nias, North Sumatra. According to an initial report from the Ministry of Maritime Affairs and Fisheries (KKP), the ship was carrying a cargo of asphalt that was supposed to be distributed to a port in western Indonesia. However, due to poor weather conditions and possible technical

[7] Andi Sitti Chairunnisa, "Legal and Practical Aspects of MARPOL Port State Control Inspections," *Collaborate Engineering Daily Book Series* 2, no. 2 (2024): 112–18, https://doi.org/10.62012/collaborate.v2i2.76.

[8] Bambang Sugeng Ariadi Subagyono et al., "Regulatory Framework on Ocean Threats –Transportation Law Analysis to Multiple Oil-Spill Cases in Indonesia," *Transactions on Maritime Science* 13, no. 2 (2024): 1–25, https://doi.org/10.7225/toms.v13.n02.w08.

[9] Aldo Chircop et al., *Area-Based Management for Arctic Shipping Canadian and Comparative Perspectives*, *Area-Based Management of Shipping: Canadian and Comparative Perspectives*, 2024, https://doi.org/10.1007/978-3-031-60053-1_9.

errors in the ship's navigation system, a leak occurred in the cargo tank, causing liquid asphalt to leak out and pollute the surrounding waters[10].

The asphalt spill was first detected by fishermen on the second day after the leak, where they found the seawater surface turning thick and oily. Residents' reports were then followed up by local government officials and the Ministry of Marine Affairs and Fisheries (KKP), who conducted a search and collected seawater samples. Initial results indicated significant amounts of hydrocarbons and bitumen originating from the ship's cargo. This spill has worsened the marine environment around Nias, which has historically been a region with a fairly productive coral reef ecosystem and fish biota[11].

In addition to the technical aspects, this chronology also indicates negligence in fulfilling administrative obligations by the ship owner. Based on the precautionary principle, every vessel transporting hazardous and toxic materials (B3) is required to have a marine pollution emergency response plan (contingency plan). However, based on preliminary investigation results, the MT AASHI failed to immediately report the incident to the relevant authorities, resulting in delayed response to the spill and widespread pollution[12].

1.2 Ecological Impact on the Marine Environment of Nias

The ecological impacts of asphalt pollution in the Nias Sea are profound and complex. Asphalt spilled into the sea has very different physical properties than light petroleum; it is thicker, heavier, and more difficult to decompose naturally. As a result, asphalt floating on the water's surface can form a thick, black layer that blocks sunlight from reaching the sea. This disrupts the photosynthesis process of phytoplankton and seagrass, which are the foundation of the marine food chain.

Furthermore, the asphalt layer adhering to the coral reef disrupts the respiration of coral polyps and ultimately kills much of the coral reef ecosystem in the affected area. This leads to the loss of habitat for small fish and the decline of marine species dependent on the ecosystem. Previous studies on oil spills have shown that the long-term impacts of hydrocarbon pollution can persist for decades if active remedial measures are not taken[13].

Furthermore, the asphalt spill also affected seawater quality by increasing the levels of Total Suspended Solids (TSS) and heavy metals. This has a direct impact on the marine food chain and can endanger the health of humans who consume seafood from the area. Legally, this indicates a violation of Article 69 paragraph (1) letter e of Law No. 32 of 2009, which prohibits anyone from polluting the environment. Regional governments and law enforcement officers have an obligation to enforce the law through administrative, criminal, and civil sanctions according to the level of error and the impacts caused[14].

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[10] Björn Hassler, "Accidental versus Operational Oil Spills from Shipping in the Baltic Sea: Risk Governance and Management Strategies," *Ambio* 40, no. 2 (2011): 170–78, https://doi.org/10.1007/s13280-010-0128-y.

[11] Eva Susanti et al., *Analysis Handling Spill Oil On Loading Operation Cargo In Prevent Pollution in the Marine Environment* (Atlantis Press International BV, 2024), https://doi.org/10.2991/978-94-6463-628-4_32.

[12] Oshadi Hettithanthri et al., "A Review of Oil Spill Dynamics: Statistics, Impacts, Countermeasures, and Weathering Behaviors," *Asia-Pacific Journal of Chemical Engineering* 19, no. 6 (2024): 1–21, https://doi.org/10.1002/apj.3128.

[13] Mella Ismelina, Liya Muliya, and Bujang Ali, "Penyelesaian Secara Hukum Masalah Ganti Rugi Pencemaran Minyak Di Laut Berdasarkan Hukum Nasional Indonesia Dan Internasional," 2020, 1–61.

[14] IOJI, "Detection And Analysis: THREATS TO MARITIME SECURITY IN INDONESIAN WATERS," *Indonesia Ocean Justice Initiative*, no. March (2023): 40, https://informatika.stei.itb.ac.id/~rinaldi.munir/Citra/2020-2021/02-Pengantar-Pengolahan-Citra-Bag2-2021.pdf.

1.3 Dampak Sosial dan Ekonomi bagi Masyarakat Pesisir

The impact of asphalt pollution in the Nias Sea is not only limited to ecological aspects, but also causes significant social and economic losses for coastal communities. Most residents around the pollution site depend on the fishing sector and marine tourism for their livelihoods. Following the asphalt spill, fishing activities ceased as fish moved away from the polluted waters, fishing nets were damaged by the sticky asphalt, and catches dropped drastically. As a result, fishermen's incomes decreased by more than 60% in the first few weeks after the incident[15].

From a social perspective, communities are also experiencing unrest and uncertainty. Polluted seawater is no longer usable for daily needs such as washing or bathing, while beaches used as tourist destinations are experiencing a decline in visitor numbers. In the long term, this pollution can lead to social degradation in the form of increased poverty and economic migration[16].

2. Kerangka Hukum Penanggulangan Pencemaran Laut di Indonesia

Marine pollution control in Indonesia has been comprehensively regulated through various ratified national and international legal instruments. As an archipelagic nation with vast maritime territory, Indonesia has a significant interest in preserving its marine resources. Marine pollution, such as that which occurred in Nias waters due to the asphalt spill from the MT AASHI ship, is a reminder that the environmental legal system, particularly in the maritime sector, remains flawed in prevention, law enforcement, and inter-agency coordination. Therefore, it is crucial to examine the legal framework that underpins marine pollution management in Indonesia, both from a normative and institutional perspective.

The national legal framework used to address marine pollution includes Law Number 32 of 2009 concerning Environmental Protection and Management (UUPPLH), Law Number 32 of 2014 concerning Maritime Affairs, and Law Number 27 of 2007 in conjunction with Law Number 1 of 2014 concerning Management of Coastal Areas and Small Islands. In addition, the government also refers to Presidential Regulation Number 109 of 2006 concerning Emergency Response to Oil Spills at Sea, which serves as a technical guideline for ministries/agencies in addressing marine pollution caused by oil or similar materials[17].

2.1 National Legal Basis for Marine Pollution Control

Marine pollution in Indonesia is a violation of environmental law provisions as regulated in Article 69 paragraph (1) letter e of Law No. 32 of 2009, which expressly prohibits anyone from polluting the environment. Actions that cause chemical or oil spills into the sea, whether intentionally or through negligence, are included in the category of unlawful acts that can be subject to administrative, civil, or criminal sanctions.

Furthermore, Article 90 of the Environmental Management Law (UUPPLH) also stipulates that any party responsible for a business that causes environmental pollution or damage is obligated to undertake mitigation and restoration efforts at their own expense. This

[15] Abdul Hamid Tome et al., "Marine Pollutions in Indonesia: Contradiction between Regulations and Settlement Conditions," *E3S Web of Conferences* 506 (2024), https://doi.org/10.1051/e3sconf/202450605004.

[16] Indien Winarwati, "Law Enforcement against Marine Pollution Foreign Ships in Indonesia," 2020, https://doi.org/10.4108/eai.26-9-2020.2302593.

[17] Imelia Agustin, Sasqia Rahmadhani, and Muhammad Fikri, "Mitigasi Penanggulangan Tumpahan Minyak (Oil Spill) Di Perairan Laut Kepulauan Riau Berdasarkan Law Of The Sea Convention," no. 2 (2024).

principle aligns with the polluter pays principle, which states that any party polluting the environment is fully responsible for all restoration costs resulting from their actions. In the MT AASHI case, the ship owners (PT RBS and PT NSI), as owner representatives, had a legal obligation to clean up the asphalt spill and compensate for all ecological and social losses incurred[18].

More specifically, Article 36 of Law No. 32 of 2014 concerning Maritime Affairs stipulates that everyone is prohibited from engaging in activities that result in marine pollution or damage. This provision reinforces general environmental regulations stipulated in the UUPPLH (Regional Environmental Management System) and provides a basis for the Ministry of Maritime Affairs and Fisheries (KKP) to carry out supervisory and law enforcement actions. In the case of the Nias Sea, the KKP's action of deploying a Special Police Team (PWP3K) and conducting airborne surveillance is a concrete form of implementing the authority stipulated in the article[19].

Furthermore, the Minister of Maritime Affairs and Fisheries Regulation (Permen KP) Number 26 of 2021 concerning Pollution Prevention, Damage Prevention, Rehabilitation, and Enhancement of Fish Resources and Their Environment serves as the technical basis for the Ministry of Maritime Affairs and Fisheries' response to such cases. This regulation stipulates that every incident of marine pollution must be responded to immediately through cross-agency coordination, clean-up measures, and the implementation of an economic valuation of losses to fish resources and marine ecosystems.

2.2 Prinsip-Prinsip Hukum Lingkungan yang Berlaku dalam Kasus MT AASHI

In the context of environmental law, the handling of marine pollution cases in the Nias Sea must be based on the application of basic principles of international and national environmental law. There are at least four main principles relevant to this case: the precautionary principle, the strict liability principle, the polluter pays principle, and the sustainable development principle.

First, the precautionary principle, as stated in the 1992 Rio Declaration, requires all parties to take preventative measures as early as possible before pollution occurs. In the case of MT AASHI, this principle was violated due to the lack of an adequate early detection and emergency response system on the part of the ship and its owner. The delay in reporting allowed the asphalt spill to spread further and cause more severe ecological impacts[20].

Second, the principle of strict liability is applied in Article 88 of the Environmental Management Law (UUPPLH), which states that the person responsible for a business that causes pollution is absolutely responsible without the need to prove fault. This means that even if an asphalt spill occurs due to bad weather or technical factors, the ship owner remains legally responsible for all resulting damage. This principle is important because in practice, proving fault in cases of marine pollution is difficult, especially when technical and complex.

[18] Hernando Pactao Bacosa et al., "From Surface Water to the Deep Sea: A Review on Factors Affecting the Biodegradation of Spilled Oil in Marine Environment," *Journal of Marine Science and Engineering* 10, no. 3 (2022), https://doi.org/10.3390/jmse10030426.

[19] Zunaira Asif et al., "Environmental Impacts and Challenges Associated with Oil Spills on Shorelines," *Journal of Marine Science and Engineering* 10, no. 6 (2022), https://doi.org/10.3390/jmse10060762.

[20] Nita Triana, Ade Tuti Turistiati, and Lincoln James Faikar Monk, "Alternative Dispute Resolution in Marine Pollution: Advancing Ecological Justice through the Polluter Pays Principle," *Volksgeist: Jurnal Ilmu Hukum Dan Konstitusi* 7, no. 1 (2024): 89–107, https://doi.org/10.24090/volksgeist.v7i1.10047.

Third, the polluter pays principle emphasizes that the costs of environmental restoration and compensation to the community must be borne by the polluter. In a press release from the Ministry of Marine Affairs and Fisheries (KKP), the MT AASHI (Aquatic Agency for Marine Affairs and Fisheries) expressed its willingness to take responsibility through a Letter of Accountability, but its implementation needs to be closely monitored to ensure it does not stop at administrative commitments.

Fourth, the principle of sustainable development requires that economic activities, including shipping and the distribution of industrial materials, not compromise the preservation of the marine environment. Failure to maintain a balance between economic activity and environmental protection can result in long-term losses that far outweigh the economic benefits. Therefore, the application of this principle is crucial in policy formulation and law enforcement related to maritime activities[21].

2.3 Government Responsibility and Inter-Agency Coordination

The government plays a central role in combating marine pollution, acting as a regulator, supervisor, and law enforcer. In the Nias Sea pollution case, the Ministry of Maritime Affairs and Fisheries (KKP) plays a key role in conducting initial investigations, collecting data, and enforcing administrative law. The KKP also coordinates with the Ministry of Environment and Forestry (KLHK), the Ministry of Transportation, and the Indonesian Navy (TNI AL) under Presidential Regulation No. 109 of 2006.

The Presidential Regulation regulates the emergency response mechanism for oil spills at sea through the establishment of a National Oil Spill Contingency Plan (NOSCP). Although asphalt is not pure oil, its similar physical properties make this regulation relevant as a guideline for technical handling. In practice, inter-agency coordination is often a major obstacle due to overlapping authorities and limited human resources in the field[22].

In addition to technical aspects, the government is also obliged to enforce administrative law, as stipulated in Article 76 of the Environmental Management Law (UUPPLH), in the form of government coercion, suspension, or revocation of business licenses for parties negligent in preventing pollution. Administrative law enforcement must be accompanied by civil and criminal law enforcement measures to provide a deterrent effect and ensure comprehensive environmental recovery.

In a normative context, the state's responsibility to maintain a good and healthy environment is also a manifestation of the constitutional rights of citizens as regulated in Article 28H paragraph (1) and Article 33 paragraph (4) of the 1945 Constitution. Therefore, any negligence by the state in preventing or handling marine pollution can be considered a violation of environmental human rights[23].

3. Law Enforcement Analysis of the Asphalt Pollution Case in the Nias Sea

[21] Rodrigo N. Vasconcelos et al., "Oil Spill Detection and Mapping: A 50-Year Bibliometric Analysis," *Remote Sensing* 12, no. 21 (2020): 1–18, https://doi.org/10.3390/rs12213647.

[22] Muhammad Firdaus Bin Yusup, "Mitigating the Impact of Oil Spills in the Sea with Responsive Strategies and Ecosystem Recovery," *Maritime Park Journal of Maritime Technology and Society* 3, no. June (2024): 22–27, https://doi.org/10.62012/mp.v3i2.35387.

[23] Akhmad Ferdinan Hairo et al., "Analysis of Oil Spill Distribution in Bintan Utara Waters Using Sentinel-1A Satellite Imagery Analisis Persebaran Tumpahan Minyak Pada Perairan Bintan Utara Dengan Menggunakan Citra Satelit Sentinel-1A" 22, no. April (2024): 48–56.

Environmental law enforcement against marine pollution in Indonesia presents unique challenges due to the multi-stakeholder, cross-sectoral involvement and complex scientific evidence. The case of crude asphalt pollution in Nias waters resulting from the grounding of the MT AASHI tanker is a clear example of the weakness of the maritime surveillance system and inter-agency law enforcement coordination. Although the Ministry of Maritime Affairs and Fisheries (KKP) has acted swiftly through the Special Police PWP3K and established clean-up measures, this case still raises fundamental questions: to what extent is the national environmental legal system capable of prosecuting the perpetrators and remediating the ecological damage that has occurred?

Conceptually, environmental law enforcement is divided into three main aspects: administrative, civil, and criminal law enforcement. All three serve to ensure legal certainty, ecological justice, and remediation of environmental damage. In the case of the Nias Sea, these three mechanisms require a comprehensive review, examining the legal basis, their implementation on the ground, and the normative and factual constraints encountered.

3.1 Administrative Law Enforcement by Relevant Ministries and Institutions

Administrative law enforcement is the government's first response to environmental law violations. Under Article 76 of Law Number 32 of 2009 concerning Environmental Protection and Management (UUPPLH), administrative sanctions can include written warnings, government coercion, permit suspension, or environmental permit revocation. The goal is not merely to punish but also to encourage perpetrators to immediately restore the polluted environment.

In the case of the asphalt spill in the Nias Sea, the Ministry of Maritime Affairs and Fisheries (KKP) has taken administrative steps through direct supervision by the Directorate General of PSDKP. The KKP conducted a field inspection, summoned the ship owners (PT RBS and PT NSI), and requested a written commitment in the form of a Letter of Accountability to handle the asphalt waste and restore the affected area. This step is in accordance with the mandate of Ministerial Regulation No. 26 of 2021 concerning Pollution Prevention, which requires business actors to bear the clean-up costs for activities that cause damage to marine resources[24].

However, from a normative perspective, administrative law enforcement is not yet fully effective because it is temporary and relies on voluntary compliance from polluters. There is no firm sanction mechanism that regulates completion deadlines, technical standards for recovery, and monitoring of cleanup results. This has the potential to create moral hazard, where perpetrators only bear partial responsibility without in-depth legal evaluation.

Furthermore, coordination between government agencies is often asynchronous. Based on Presidential Decree No. 109 of 2006, marine pollution management should involve the Ministry of Transportation, the Ministry of Environment and Forestry (KLHK), the Indonesian Navy (TNI AL), and the National Search and Rescue Agency (BASARNAS). However, in practice, authority between agencies often overlaps, causing delays in cleanup efforts and the enforcement of administrative sanctions. Therefore, even though administrative law enforcement has been carried out according to procedure, its effectiveness still needs to be

[24] Irma Rachmawati Maruf, *Water Pollution Caused by Collision and Its Impact on The Marine Environment* (Atlantis Press SARL, 2023), https://doi.org/10.2991/978-2-38476-180-7_92.

strengthened with an integrated evaluation system and the full application of the principle of "responsibility and accountability" to ships and business owners[25].

3.2 Civil Law Enforcement: Responsibility for Compensation and Ecological Restoration

The second aspect of environmental law enforcement is civil liability. Under Article 87 of the Environmental Management Law (UUPPLH), those responsible for businesses causing pollution are required to restore the environment and pay compensation to affected communities. In the context of marine pollution, civil liability extends beyond economic losses to coastal communities and also encompasses ecological losses, such as damage to coral reef ecosystems, seagrass beds, and marine biota.

In a 2023 press release from the Ministry of Marine Affairs and Fisheries (KKP), it was stated that the Ministry would form an Economic Valuation Expert Team to calculate damage to fish resources and the environment. This step aligns with Ministerial Regulation No. 28 of 2020 concerning Procedures for Dispute Resolution in the Management of Coastal Areas and Small Islands, which allows for the resolution of environmental disputes through non-litigation or out-of-court mechanisms. This mechanism is considered faster and more effective in determining compensation, especially if the parties are willing to cooperate in the restoration process[26].

However, from an academic perspective, out-of-court dispute resolution has limitations, particularly regarding executory power. The resulting agreement does not have the binding force of a court decision, so if the polluter fails to fulfill its obligations, the community or government must pursue new litigation. Therefore, non-litigation mechanisms should be followed by court rulings (homologation) to ensure they have the same legal force as a judge's decision.

Civil liability is also regulated through the principle of strict liability as stipulated in Article 88 of the UUPPLH. This principle is highly relevant in the MT AASHI case because the pollution occurred due to technical negligence (the ship ran aground due to bad weather), not intentional. Nevertheless, the ship owner remains fully responsible without the need for proof of fault. Therefore, legal liability cannot be shifted to natural factors, as environmental risks are part of the obligation to exercise prudence in business management[27].

If the economic valuation calculation shows significant losses to the marine environment and society, then the polluter is obliged to bear the costs of long-term ecological recovery, including rehabilitation of coastal ecosystems, compensation for fishermen's losses, and regular monitoring of seawater quality.

3.3 Criminal Law Enforcement: Accountability for Environmental Unlawful Acts

Enforcing environmental criminal law is a form of ultimum remedium, a last resort when administrative and civil sanctions are ineffective or when the pollution was committed

[25] Susanti et al., *Analysis Handling Spill Oil On Loading Operation Cargo In Prevent Pollution in the Marine Environment*.

[26] Siwarut Laikram, Shubham Pathak, and Muhammad Yaseen, "Averting an Oil Spill Disaster through Legal Measures and Law Implementations," *Frontiers in Marine Science* 12, no. September (2025): 1–15, https://doi.org/10.3389/fmars.2025.1632601.

[27] Eleftheria Kalogirou et al., "Oil Spill Detection Using Convolutional Neural Networks and Sentinel-1 SAR Imagery," *International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences - ISPRS Archives* 48, no. G-2025 (2025): 757–64, https://doi.org/10.5194/isprs-archives-XLVIII-G-2025-757-2025.

with a high degree of negligence. In the case of the Nias Sea, the potential for criminal sanctions can be seen in Articles 98–103 of the Environmental Management Law (UUPPLH), which stipulate criminal penalties for anyone who intentionally or negligently causes environmental pollution. Article 99 paragraph (1) of the UUPPLH explicitly states:

"Any person who, through negligence, results in exceeding environmental quality standards shall be punished with a maximum imprisonment of three years and a maximum fine of three billion rupiah."

In the context of the MT AASHI, although the primary cause of the grounding was bad weather, the tank leak and ballast system failure indicate negligence in the ship's maintenance. If it is proven that the shipowner or operator failed to conduct seaworthiness tests in accordance with international standards (the MARPOL Convention), then the element of legal negligence is met and criminal sanctions may be imposed[28].

In addition to the UUPPLH (Environmental and Environmental Management Law), criminal provisions can also be applied under Law No. 32 of 2014 concerning Maritime Affairs. Article 52 states that anyone engaging in activities that cause marine pollution can be punished with a maximum of 10 years' imprisonment and a fine of up to IDR 10 billion. This means that in the case of pollution of the Nias Sea, there are two criminal law instruments that can be applied cumulatively or alternatively, depending on the results of the investigation and field evidence.

However, the main challenge in enforcing environmental crimes in Indonesia is proving the elements of culpability and the causal relationship between the perpetrator's actions and the pollution impacts. Scientific evidence regarding the distribution of pollutants, the extent of damage to marine life, and the direct link to the perpetrator's activities is often difficult to prove in court. Therefore, the involvement of environmental experts, oceanographers, and marine forensic chemists is crucial in strengthening legal evidence[29].

Furthermore, there is an overlap between administrative and criminal law. In many cases, perpetrators who have been subject to administrative sanctions are deemed to have fulfilled their responsibilities, so criminal proceedings are not pursued. However, legally, these two mechanisms can operate parallel as long as there are different elements of the unlawful act (e.g., technical negligence vs. actual pollution).

3.4 Constraints and Evaluation of the Effectiveness of Environmental Law Enforcement

One of the primary challenges lies in suboptimal inter-agency coordination. The Ministry of Marine Affairs and Fisheries (KKP), the Ministry of Environment and Forestry (KLHK), and the Ministry of Transportation possess overlapping authorities, particularly in determining the institution responsible for pursuing compensation for marine environmental damage. This overlap of authority contributes to delays and inefficiencies in the legal settlement process. Second, the lack of human resources and technical facilities in the regions makes it difficult to monitor marine pollution quickly. In the case of MT AASHI, initial monitoring was only conducted after the ship was 70% submerged and the asphalt had spread

[28] T. Avikasis Cohen, A. Brook, and D. Angel, "A Novel Approach in Oil Spill Detection, Identification, and Classification Via Multisource Technologies and Artificial Intelligence," *International Geoscience and Remote Sensing Symposium (IGARSS)* XLVIII, no. May (2024): 5911–14, https://doi.org/10.1109/IGARSS53475.2024.10641173.

[29] Emilio D'Ugo et al., "A Sentinel-2-Based System to Detect and Monitor Oil Spills: Demonstration on 2024 Tobago Accident," *Remote Sensing* 17, no. 2 (2025): 1–7, https://doi.org/10.3390/rs17020230.

over a radius of more than 15 nautical miles. This delay resulted in more severe ecological impacts and complicated law enforcement[30].

Third, scientific evidence in pollution cases remains a major challenge. Scientific evidence regarding pollutant levels, ecosystem damage, and the causal relationship between human activities and pollution is often difficult to obtain quickly due to limited laboratories and marine environmental data in Indonesia.

Fourth, legal awareness among maritime businesses remains low. Many shipping companies lack adequate emergency response plans, often delaying initial response to pollution. This highlights the need for the state to strengthen compliance mechanisms through stringent environmental audits and ship certification[31].

Finally, from a normative perspective, synchronization between the UUPPLH, the Maritime Law, and Presidential Decree No. 109 of 2006 is necessary to avoid dual authority. The establishment of a National Maritime Pollution Response Center could be a solution to ensure rapid cross-agency coordination in any future marine pollution incidents.

4. General Analysis of the Asphalt Pollution Case in the Nias Sea

The asphalt pollution incident in the Nias Sea, caused by a spill from the MT AASHI tanker, was a significant event highlighting the weak oversight system and legal accountability for shipping activities carrying hazardous materials. This incident had serious ecological and social impacts. The asphalt leaked into the sea formed a thick layer on the water's surface, covering coral reefs and inhibiting oxygen exchange, which is essential for marine ecosystems. Fishermen in the area also suffered losses due to the pollution of their fishing grounds and a drastic decline in catches.

Legally, this incident can be categorized as a form of marine pollution, namely the entry of substances or energy into the marine environment due to human activities that cause disruption to the biological, ecological, and economic functions of the marine environment itself. Based on Law Number 32 of 2009 concerning Environmental Protection and Management (UUPPLH), any act that results in pollution must be followed up through recovery efforts and law enforcement against the responsible parties. Therefore, the MT AASHI case is not only a technical marine issue, but also a legal issue concerning the state's responsibility in protecting the community's rights to a good and healthy environment[32].

4.1 Analysis Based on Environmental Law Principles

Environmental law recognizes a number of important principles that serve as the basis for assessing and resolving pollution cases, including the precautionary principle, the polluter pays principle, and strict liability. These principles stem not only from national law but also form part of international agreements such as the Stockholm Declaration of 1972 and the Rio Declaration of 1992.

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[30] Ronald Buss de Souza and Rubens M. Lopes, "Environmental Variability and Hazards in the Coastal and Continental Shelf Regions of South America and the Caribbean," *Ocean and Coastal Research* 71, no. suppl 2 (2023): 1–4, https://doi.org/10.1590/2675-2824071.24004rbs.

[31] Qingsheng Xue et al., "Research on Marine Oil Spill Identification Based on Laser-Induced Fluorescence LiDAR," *Intelligent Marine Technology and Systems* 2, no. 1 (2024), https://doi.org/10.1007/s44295-024-00037-0.

[32] Md Jainal Abedin et al., "Assessments of Heavy Metal Contamination Found in Environmental Samples from Informal E-Waste Recycling Communities in Chattogram City, Bangladesh," *Journal of Hazardous Materials Advances* 19, no. July (2025): 100845, https://doi.org/10.1016/j.hazadv.2025.100845.

The application of the precautionary principle means that activities with the potential to cause pollution must be controlled from the outset through environmental permits, environmental audits, and periodic monitoring. In the case of MT AASHI, violations of this principle were evident in the weak oversight system for ships transporting hazardous materials. Ships should be equipped with cargo security systems, emergency procedures, and a plan for responding to hazardous materials spills at sea.

The polluter pays principle requires the polluter to bear the full cost of environmental restoration without transferring the burden to the community or the government. In the context of the asphalt spill in the Nias Sea, the MT AASHI ship owner is therefore fully responsible for the costs of cleanup and ecosystem rehabilitation. This principle is consistent with Article 87 of the Environmental Management Law (UUPPLH), which obliges every business entity to undertake restoration measures when its activities cause environmental pollution or damage.The principle of strict liability stipulates that in cases of environmental pollution, the perpetrator can be held accountable without proof of fault. This is consistent with the nature of hazardous materials transportation, which poses a high risk to the environment. This means that even if an asphalt spill occurs due to bad weather or factors beyond their control, legal responsibility remains with the ship and its operators.

4.2 Analysis of the Legal Responsibility of the MT AASHI Ship

Under Indonesian law, a vessel's liability in marine pollution cases covers three main areas: administrative, civil, and criminal. Administratively, the vessel owner or operator is required to take prompt action to mitigate the pollution and report the incident to the relevant authorities. Failure to take immediate action constitutes a violation of Minister of Maritime Affairs and Fisheries Regulation No. 26 of 2021 concerning Pollution Prevention, Damage Prevention, Rehabilitation, and Improvement of Fish Resources and the Environment.

Under civil law, the ship's management is responsible for providing compensation for the environmental and social losses incurred. This compensation includes the restoration of marine conditions, loss of fish resources, and economic losses to coastal communities. Under Article 88 of the Environmental Management Law (UUPPLH), the party responsible for the business or activity causing the pollution is obligated to cover these losses even without proof of fault. Therefore, in the case of MT AASHI, legal liability is absolute.

From a criminal perspective, Article 99 of the Environmental Management Law (UUPPLH) stipulates that any person who negligently causes environmental pollution can be subject to a maximum prison sentence of three years and a fine of up to three billion rupiah. If proven to have technical negligence, such as tank system failure, inadequate vessel maintenance, or violation of shipping safety procedures, criminal sanctions can be imposed on the captain or the ship's management. Furthermore, criminal sanctions can be imposed on corporations if it is proven that company policies ignore safety and environmental aspects.

This legal responsibility aligns with the principles of international law, particularly the MARPOL Convention 73/78 and the 1982 United Nations Convention on the Law of the Sea (UNCLOS), which oblige coastal states to take firm measures against pollution from ships. Therefore, Indonesia has a strong basis for demanding legal accountability both nationally and within the framework of international cooperation if the perpetrator of the pollution is a foreign-flagged vessel[33].

[33] Mehdi Belhani, Hamouda Boutaghane, and Rym Asma Boufas, "Effect of Future Environmental Laws on the Wwtp Sustainability in Algeria – Case Study on Phosphorus Discharges and Sewage Sludge Management,"

4.3 Analysis of Law Enforcement and its Effectiveness in the Field

Environmental law enforcement in Indonesia, particularly in marine pollution cases, often faces serious challenges. One major obstacle is suboptimal coordination between institutions. In the MT AASHI case, multiple parties were involved, including the Ministry of Maritime Affairs and Fisheries, the Ministry of Environment and Forestry, the Indonesian Navy, and local governments. However, this cross-sectoral coordination is often hampered by overlapping authorities and slow law enforcement.

Another weakness lies in the limited technical capacity to conduct scientific investigations to prove the extent of pollution and determine environmental compensation. As a result, many marine pollution cases end at the administrative stage, without any criminal or civil sanctions to provide a deterrent effect. However, Article 95 of the Environmental Management Law (UUPPLH) stipulates that environmental law enforcement must be implemented through three main instruments: administrative, civil, and criminal, which complement each other.

The public dissemination of cases, such as the asphalt spill in the Nias Sea, can generate social pressure on government institutions and law enforcement authorities to act more transparently and accountably. Furthermore, the active involvement of coastal communities, fishermen, and environmental organizations can enhance oversight in ensuring the proper implementation of environmental recovery and compensation obligations by responsible parties.

Thus, it can be concluded that law enforcement in the MT AASHI case still faces structural and technical obstacles. Strong synergy between the central and regional governments, strengthening the technical capacity of law enforcement agencies, and a commitment to firmly enforcing legal sanctions without discrimination are required. If this can be achieved, environmental law enforcement will serve not only as a response to pollution but also as an effective preventive measure to protect the sustainability of Indonesia's marine resources[34].

5. Effectiveness of Environmental Law Enforcement in Marine Pollution Cases

Environmental law enforcement in Indonesia still faces various obstacles, both in terms of legal substance, institutional structure, and community legal culture. In the case of asphalt pollution in the Nias Sea, it is clear that although the government has taken steps to address and clean up the situation, the legal enforcement process against those responsible has been slow and has not yet shown decisive results. This indicates a weak accountability system in addressing marine pollution, which should be a national priority.

One fundamental problem is the lack of synchronization between regulations and law enforcement agencies. In this context, the Ministry of Maritime Affairs and Fisheries (KKP) holds primary authority under Law Number 27 of 2007 in conjunction with Law Number 1 of 2014 concerning the Management of Coastal Areas and Small Islands, and Government Regulation Number 27 of 2021 concerning the Implementation of the Maritime Affairs and Fisheries Sector. However, in practice, pollution management also involves the Ministry of

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Desalination and Water Treatment 209, no. October 2019 (2021): 437–46, https://doi.org/10.5004/dwt.2021.26545.

[34] Maria Loredana Popescu, "Waste Electrical and Electronic Equipment Management in Romania: Harmonizing National Environmental Law with European Legislation," *Administratie Si Management Public* 188, no. 22 (2014): 65–72, https://doi.org/10.1016/j.sbspro.2015.03.389.

Environment and Forestry (KLHK) and the Ministry of Transportation, which are responsible for shipping safety. Coordination between these agencies is often ineffective due to overlapping functions and delays in determining legal responsibility[35].

The effectiveness of law enforcement is also influenced by the technical capacity of authorities to gather scientific evidence of pollution. Asphalt pollution is not a common type of oil pollution, requiring specialized methods for identifying and valuing environmental damage. The inability to conduct an economic valuation of damage often results in law enforcement stopping at the administrative or informal compensation stage, with no criminal enforcement action. In an ideal environmental law system, every form of pollution should be accompanied by proportionate legal accountability, including criminal penalties for negligent corporations and individuals.

Normatively, the effectiveness of law enforcement should be measured based on the principle of ecological justice. This principle emphasizes that law enforcement aims not only to impose punishment but also to ensure ecosystem restoration and justice for affected communities. Therefore, the MT AASHI case should not be viewed solely from an administrative perspective, but also as a momentum to strengthen the environmental legal system in the maritime sector to make it more responsive and ecologically just[36].

5.1 The Relevance of the Principle of State Responsibility in Marine Protection

As an archipelagic nation with vast maritime territory, Indonesia has a constitutional responsibility to preserve the marine environment. This mandate is stipulated in Article 33 paragraph (3) of the 1945 Constitution, which states that the land, water, and natural resources contained therein are controlled by the state and used to the greatest extent possible for the prosperity of the people. In the context of the pollution case in the Nias Sea, the state's responsibility includes supervision, prevention, law enforcement, and post-incident environmental recovery.

This principle of state responsibility is also emphasized in Law Number 32 of 2014 concerning Maritime Affairs, which obliges the government to protect marine ecosystems from the threat of pollution and damage. However, in practice, the government is often slow to respond quickly to ecological disasters such as asphalt spills. Unprepared emergency response equipment, limited human resources in the field, and weak coordination result in lengthy and suboptimal cleanup processes[37].

The use of satellite imagery, aerial surveys, and laboratory analysis should form the evidentiary basis of legal proceedings to ensure objective, reliable, and accountable outcomes in court. The lack of robust scientific evidence has frequently been identified as a major constraint in the enforcement of environmental law, often resulting in cases being resolved without the imposition of significant sanctions on perpetrators.

State involvement in this case should not stop at administrative measures or inter-agency coordination, but must be realized through concrete and transparent law enforcement.

[35] E. García-Gómez et al., "Identification of Emerging Contaminants in Greywater Emitted from Ships by a Comprehensive LC-HRMS Target and Suspect Screening Approach," *Environmental Pollution* 366, no. December 2024 (2025), https://doi.org/10.1016/j.envpol.2024.125524.

[36] García-Gómez et al.

[37] Alessandro Cau et al., "What, Where, and When: Spatial-Temporal Distribution of Macro-Litter on the Seafloor of the Western and Central Mediterranean Sea," *Environmental Pollution* 342, no. August 2023 (2024): 123028, https://doi.org/10.1016/j.envpol.2023.123028.

The state must ensure that all remediation costs are borne by the polluters and that coastal communities receive adequate compensation. Implementing the principle of state responsibility thus presents a real test for the government in demonstrating its commitment to protecting the marine environment[38].

5.2 The Role of Society and Ecological Justice for Victims of Pollution

From a modern environmental law perspective, communities play a strategic role in monitoring, reporting, and participating in environmental restoration processes. The asphalt spill in the Nias Sea demonstrates that coastal communities are the most directly impacted, both economically and socially. Fishermen's livelihoods are disrupted, the marine ecosystem they depend on for their livelihoods is damaged, and the quality of the surrounding environment is degraded.

According to the principles of environmental democracy, every citizen has the right to obtain information, participate in decision-making, and obtain justice for environmental damage inflicted upon them. However, in many cases, including the incident in Nias, communities are often not actively involved in the dispute resolution process or in the assessment of environmental losses. However, according to Minister of Maritime Affairs and Fisheries Regulation Number 28 of 2020, environmental dispute resolution in coastal areas can be conducted through out-of-court mechanisms involving representatives of affected communities[39].

Ecological justice will not be achieved if communities remain passive victims without the opportunity to voice their rights. Therefore, community involvement in the development of recovery plans and compensation assessments is a crucial step to ensure that the legal process is fair. Local governments, along with the Ministry of Marine Affairs and Fisheries (KKP), should facilitate the formation of an independent team involving academics, environmental experts, and local community representatives to conduct impact analyses and loss assessments. In this way, the law enforcement process will not only focus on the perpetrators but also restore the dignity of coastal communities as part of ecological justice[40].

5.3 Strengthening Legal Instruments and Institutions in Environmental Law Enforcement

To ensure similar cases do not recur, strengthening legal instruments and institutions is imperative. Indonesia already has a fairly comprehensive set of environmental laws, including the Environmental Management Law (UUPPLH), the Maritime Law, and even ministerial technical regulations. However, the main weakness lies in implementation and coordination between institutions. An integrated system is needed to regulate the prevention, emergency

[38] Cau et al.

[39] D. Marinos-Kouris and A. Mourtsiadisb, "Planned Industrial Estates under Law 2545/97: An Empirical Analysis of Wastewater Treatment Systems," *Desalination and Water Treatment* 39, no. 1–3 (2012): 256–61, https://doi.org/10.5004/dwt.2012.3361.

[40] Andreas Gondikas, Karin Mattsson, and Martin Hassellöv, "A New Form of Hazardous Microparticulate Contamination to the Marine Environment from Ships Using Heavy Fuel Oil with Exhaust Gas Scrubbers – Characterization and Implications for Fate, Transport and Ecotoxicity," *Science of the Total Environment* 959, no. December 2024 (2025), https://doi.org/10.1016/j.scitotenv.2024.178263.

response, and recovery mechanisms for marine pollution, including the establishment of a national institution focused on handling hazardous and toxic material spills at sea[41].

The use of satellite imagery, aerial surveys, and laboratory analysis should form the evidentiary basis of legal proceedings to ensure objective, reliable, and accountable outcomes in court. The lack of robust scientific evidence has frequently been identified as a major constraint in the enforcement of environmental law, often resulting in cases being resolved without the imposition of significant sanctions on perpetrators.

They must be equipped with technical expertise, adequate maritime patrol facilities, and strong investigative powers. This way, the environmental legal system will not only be reactive after pollution occurs, but also proactive in preventing environmental damage.

CONCLUSION

The case of crude asphalt pollution in the Nias Sea caused by the grounding of the MT AASHI tanker is a clear reflection of the weakness of the marine environmental prevention and law enforcement system in Indonesia. From the results of this study, it can be concluded that law enforcement against marine pollution has not been running optimally, both in terms of inter-agency coordination, regulatory effectiveness, and the implementation of environmental law principles such as the polluter pays principle, strict liability, and the precautionary principle. This case confirms that the legal liability mechanism for marine pollution still tends to be administrative and has not yet created a deterrent effect on perpetrators of pollution.

From a normative legal perspective, legal responsibility for marine pollution should be based on the principle of strict liability, whereby the ship owner is obligated to bear the full costs of environmental restoration and community losses without requiring proof of fault. However, in practice, the implementation of this principle remains weak due to the lack of an effective and independent legal mechanism for assessing damage and determining environmental compensation. Meanwhile, the government, through the Ministry of Maritime Affairs and Fisheries (KKP), has attempted to implement enforcement measures involving various relevant ministries, but asynchronous coordination often hinders the expeditious legal process. Beyond substantive legal aspects, this case also highlights weaknesses in the structural aspects of law enforcement. The limited technical capacity of law enforcement officials in the marine and environmental sectors has slowed down the scientific evidence-based assessment of the impacts of pollution. Scientific evidence, such as satellite observations, aerial survey data, and laboratory results, is crucial for enforcing science-based marine environmental law. Without strengthening these technical aspects, law enforcement has the potential to stall at the administrative stage, without providing criminal sanctions or adequate compensation for affected communities.

In the context of national and international environmental law, Indonesia has a constitutional and moral obligation to protect the sea from pollution. Ratification of the 1982 Convention on the Law of the Sea (UNCLOS) strengthens the country's legal position to hold accountable for any acts of pollution within national jurisdiction. However, the implementation of this obligation at the national level remains suboptimal due to weak synergy between legal instruments and technical enforcement policies. Therefore, a comprehensive overhaul of the marine environmental legal system is needed to make it more assertive, integrated, and in favor of ecological justice. From a social and ecological perspective, coastal communities, as the

[41] Christopher C. Joyner, "The 1991 Madrid Environmental Protection Protocol: Contributions to Marine Pollution Law," *Marine Policy* 20, no. 3 (1996): 183–97, https://doi.org/10.1016/0308-597X(96)00012-7.

most impacted parties, have not yet fully received justice. The right to a good and healthy environment as guaranteed in Article 28H paragraph (1) of the 1945 Constitution, is still often neglected when marine pollution occurs. The out-of-court dispute resolution mechanism as stipulated in the Regulation of the Minister of Maritime Affairs and Fisheries Number 28 of 2020 is indeed a progressive step, but it must be implemented with the direct involvement of affected communities so that the compensation and recovery process is fair and transparent.

This study concludes that environmental law enforcement efforts in the Nias Sea pollution case must focus on four main areas. First, strengthening coordination between government agencies authorized to monitor and enforce maritime law. Second, clarifying the legal accountability mechanisms for corporations in marine pollution cases to prevent perpetrators from evading their obligations. Third, improving the technical capacity of marine environmental law enforcement agencies to provide accurate and prompt scientific evidence. Fourth, ensuring the active involvement of coastal communities in all dispute resolution and environmental restoration processes, as part of realizing ecological justice and the right to a healthy environment. Therefore, the Nias Sea asphalt pollution case is not merely a legal event, but also a reflective moment for Indonesia to strengthen a more just and sustainable marine environmental legal system. Going forward, concrete steps are needed in the form of establishing an integrated marine pollution mitigation agency, strengthening prevention-oriented regulations, and implementing strict sanctions for all forms of environmental violations. Only in this way can environmental law truly function as an instrument of ecological protection that favors the sea and future generations of the nation.

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