

# ***Research on International Marine Pollution Control Issues: Based on the Fukushima Pollution Incident in Japan***

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**Abstract:** The international marine environment has increasingly become a critical focus of global environmental concerns, with marine pollution worsening significantly. The Fukushima sewage incident in Japan has notably heightened awareness of marine environmental pollution, impacting the marine environment, economic development, food safety, and human health in surrounding countries, making marine pollution control an urgent priority. This paper analyzes the Fukushima pollution incident in Japan, reviewing the current status of international marine pollution control legal treaties and international cooperation efforts. It proposes new governance ideas grounded in climate change advisory opinions, emphasizing the need for innovative approaches to tackle emerging pollution challenges. Furthermore, the paper examines both theoretical and practical problems within the existing framework of international marine pollution control, identifying gaps and inconsistencies that hinder effective management. Based on this analysis, the paper offers comprehensive countermeasures and suggestions aimed at enhancing the efficacy of international treaties, improving coordination among nations, and strengthening the overall governance structure to better address marine pollution. This holistic approach is essential for ensuring the sustainable development of marine ecosystems and the long-term health and prosperity of human societies.

**Keywords:** International marine pollution, pollution control, international conventions, Fukushima pollution incident.

## **1. Introduction**

The Fukushima Daiichi Nuclear Power Plant will release radioactive wastewater into the sea, as announced by the Japanese government on April 9, 2021. By August 24, 2023, the plant had begun releasing this water, with the sixth round of discharge completed by June 4, 2024. This decision has drawn widespread international attention and opposition, significantly impacting the global marine environment and posing threats to the marine ecosystems, economic development, food safety and human health of neighboring countries.

Marine pollution control has become a critical issue for the international community, involving multiple stakeholders working together. Current domestic research mainly addresses the treaties or principles violated by Japan's actions and their legal implications, but lacks specific studies on marine pollution and practical control measures. As the Fukushima disaster has demonstrated, there are

international rules and treaties like as the United Nations Convention on the Law of the Sea that offer principles, but there are notably few real-world examples and governance mechanisms.

Internationally, scholars have little research on the Fukushima pollution incident in Japan, and most of them are studies on the marine environment and pollution control, as well as research on the current situation and existing problems of different entities to accumulate international laws and international treaties to solve marine pollution problems. Solena Guggisberg [1] discussed land-based international marine litter management and liability, raising the need to improve legal uncertainties and related treaties. Karin Otsuka, Trudeau [2] used Okinawa as an example to provide solutions to the problem of marine pollution on islands and the views of island countries on marine pollution. Maya Saliba [3] et al. analyzed the methods for holding polluters accountable, looked at the pollution from land-based sources and shipping leaks in the North Sea ocean governance, and brought up the challenges of repair and compensation for biodiversity loss caused by pollution.

Chinese scholars have presented comprehensive analysis and multifaceted viewpoints on this subject. Gong Wei [4] went into great detail regarding the advisory opinion issued by the International Tribunal for the Law of the Sea regarding the responsibilities of States with regard to climate change, highlighting the significance of international law in safeguarding the marine ecosystem. The release of nuclear sewage from Fukushima into the sea was the main topic of Guo Ping and Yu Hanming's [5] discussion. They claimed that this breached pertinent provisions of the United Nations Convention on the Law of the Sea, particularly Articles 192 and 194, and they also brought up Japan's accountability for the incident. From the standpoint of an international dispute settlement process, Gao Shenjie and Xiao Bing [6] examined the judicialization conundrum and the potential for reform and offered a fresh approach to resolving related marine pollution issues. Zhang Hua [7] gives theoretical support for China's role positioning and strategic choice in international ocean governance in his work, which addresses the judicial strengthening of international marine environmental legislation and its illumination to China. From the standpoint of state accountability, Li Yuanyuan and Zhang Yan [8] talked on the potential for international legal culpability resulting from Japan's nuclear sewage spill into the sea at Fukushima. The background, jurisprudence, and spillover effects of the Tribunal for the Law of the Sea climate advisory case were thoroughly examined by Li Wanqiang, Tian Haoyu, and Guo Jianping [9]. They also objectively evaluated the potential and constraints of international judicial institutions in advancing national climate obligations. According to Guo Ran [10], the Japanese government's decision to release nuclear wastewater from Fukushima is against international law, but it is difficult to enforce compliance. As a result, China should support a shared future for all people, strengthen international nuclear safety regulations, and strengthen oversight to make sure Japan abides by the law.

Based on that, this paper aims to provide theoretical support and new perspectives on marine pollution control through the study of the Fukushima wastewater incident. Marine environmental protection is crucial globally, and effective governance is urgently needed as pollution problems worsen. In order to enhance global marine pollution management, this study examines the status of marine pollution control at the moment, points out problems, and suggests fixes. Additionally, this paper offers practical guidance for future governance, emphasizing the need for updated legislation and international cooperation. The discussions and recommendations aim to contribute to future international marine environmental governance and pollution control.

The structure of the paper is as follows: After the introduction and literature review, the second part reviews marine pollution control, relevant international laws, and the roles of international and regional organizations. The third part puts forward the problems arising from legal analysis. The forth part puts forward suggestions and countermeasures for solving the relevant problems. Finally, the conclusion summarizes findings and proposes future prospects.

## **2. Development Status of International Marine Pollution Control**

### **2.1. The Current Status of International Marine Pollution Control Laws**

International environmental law includes various United Nations conventions and declarations, though documents specifically addressing marine pollution are limited. Most regulations focus on climate and biological aspects, such as the Stockholm Convention on Persistent Organic Pollutants. Adopted by the United Nations General Assembly on 22 May 2001 and open for signature, ratification and accession, the Convention aims to protect human health and the environment from persistent organic pollutants (POPs), as set out in principle 15 of the Rio Declaration on Environment and Development. There are 30 articles in the full text, of which "Article 3 Measures to Reduce or Eliminate Emissions from Intentional Production and Use", "Article 5 Measures to Reduce or Eliminate Emissions from Unintentional Production", and "Article 6 Measures to Reduce or Eliminate Emissions from Stockpiles and Wastes" are all related to chemical releases. These articles address chemical releases and include procedural provisions for implementation, dispute settlement, and other related activities [11].

The international law of the sea further expands on the legal frameworks governing marine pollution. This body of law covers various aspects, including the territorial sea, the high seas, living resources, and the continental shelf. The United Nations Convention on the Law of the Sea (UNCLOS) is a comprehensive legal framework with relevant provisions on marine pollution. It consists of 17 parts, a total of 320 articles, and 9 annexes. It establishes boundaries between various legal zones, governs their usage, protects the marine environment, and specifies the procedures for resolving conflicts between two or more parties. Among them, "Part 12 Protection and Preservation of the Marine Environment" is the relevant provisions of marine pollution control, which is mainly divided into content and procedural provisions. This part has 11 sections, from Article 192 to Article 237. The main contents are measures to improve marine environmental pollution, global and regional cooperation, and relevant regulations, implementation, responsibilities, and obligations related to pollution from different sources, all of which are related to marine pollution control.

Beyond these primary sources, other international treaties and agreements also contribute to marine pollution control. These include declarations and treaties not fully integrated into the United Nations frameworks but still holding significant authority. Often proposed by regional organizations, economic communities, and other bodies, these treaties may only be binding in specific regions. Key examples include the Barcelona Convention for the Protection of the Eastern Mediterranean against Pollution, the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, the International Convention on Oil Pollution Preparedness, Response and Co-operation, the International Convention for the Prevention of Pollution from Ships (MARPOL), and the Convention on Transboundary Environmental Impact Assessment. These conventions often address specific aspects or regions of marine pollution, providing targeted solutions with a higher likelihood of implementation.

In addition to these binding agreements, various soft law documents and international customs also play a role in marine pollution control. These resources address the plastics trade and advocate for a decrease in marine litter. The Rio Declaration on Environment and Development, the Honolulu Strategy, the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities, the Food and Agriculture Organization's Code of Conduct for Responsible Fisheries, and the United Nations Fish Stocks Agreement are a few notable examples [12]. The Rio Declaration, a key outcome of the 1992 United Nations Conference on Environment and Development in Rio de Janeiro, Brazil, contains 27 principles addressing the relationship between the environment and development. This document serves as a representative example of customary international law in ocean governance and underscores the global commitment to addressing marine pollution.

## **2.2. Status Quo of International Cooperation in International Marine Pollution Control**

In international marine pollution control, cooperation among nations is essential due to the transboundary nature of marine environments, which necessitates solutions involving multiple stakeholders. Cooperation occurs at various levels, from large-scale international collaborations to more localized regional and local efforts.

The broad viewpoint will be more planning because international organizations encompass a wide range of subjects, a wide range of countries and regions, a high degree of subject participation, and a strong global planning vision. The main responsibilities are the overall planning and deployment of different areas such as the environment, maritime navigation and pollution, marine science, etc. Among the international organizations, the United Nations Environment Programme (UNEP), the United Nations Environment Assembly, the International Maritime Organization (IMO), the Intergovernmental Oceanographic Commission of UNESCO (IOC/UNESCO), and the International Seabed Authority (ISA) are represented. For instance, the IOC/UNESCO is the sole United Nations agency mandated to support global ocean science and services, coordinating the preparation and implementation of the United Nations Ocean Decade Conference. IMO has adopted 51 international shipping regulatory treaties, with 21 directly related to environmental protection.

Regional cooperation through Regional Seas Conventions and Action Plans (RSCAPs) is a crucial tool for international ocean management. Over 40 conventions, agreements and protocols for the protection of regional seas worldwide to protect regional seas, covering at least 18 maritime areas [13]. Regional conventions allow countries to agree on common goals and activities tailored to specific regions, making implementation more feasible than broad international rules. UNEP's Regional Seas Programme, established in 1974, is a significant regional mechanism for marine and coastal environmental protection, with three types of regional conservation plans across 18 regions.

Independent organizations, comprising groups of countries or economic communities, work together to address specific regional problems, develop strategies, protect, and restore the marine ecological environment, and achieve sustainable development. Furthermore, non-UNEP managed organizations also contribute significantly to regional marine pollution control efforts.

## **2.3. New Ideas for International Marine Pollution Control: Climate Advice**

In light of climate change, the management of marine pollution has grown in significance, inspiring new strategies and concepts for global collaboration. Critical questions regarding States' obligations under UNCLOS regarding marine pollution were raised by the Small Island States Commission (SIDS) in December 2022 when they submitted a request for an advisory opinion on climate change and international law to the International Tribunal for the Law of the Sea. This included problems with sea level rise, ocean acidity brought on by greenhouse gas emissions from human activity, and ocean warming. In order to avoid, reduce, and regulate marine pollution and safeguard the marine environment from the effects of climate change, it is imperative that States have a clear knowledge of their respective roles in these areas, as this request made apparent [14].

These issues were covered in the advisory opinion that the International Tribunal for the Law of the Sea released on May 24, 2024, highlighting States' duties under UNCLOS to save and maintain the maritime environment. The UNCLOS's Articles 192, 194, and 207 specify the precise actions that nations must take to stop, lessen, and manage marine pollution from a variety of sources, including greenhouse gases. This advisory opinion provides a legal basis for managing marine pollution and underscores the international community's commitment to marine environmental protection.

Climate advice opinions offer several advantages as a new governance approach for global marine pollution control. Unlike traditional negotiation and adjudication, these opinions provide authoritative and expert legal interpretations, helping countries understand their obligations and reducing

implementation discrepancies caused by varying interpretations. Additionally, climate advisory opinions are less influenced by international politics, allowing them to more accurately reflect the severity of environmental issues and the feasibility of potential solutions. This independence encourages proactive measures and brings greater international attention to marine pollution.

The flexible process of climate advisory opinions allows for swift responses to specific issues, providing timely legal support for marine pollution control. This rapid response capability is particularly important for addressing urgent problems like climate change. However, there are challenges to the feasibility of climate advisory opinions. Since they are voluntary legal opinions, their enforceability depends on States' willingness to comply. Furthermore, debates about their legal basis and jurisdictional implications can undermine their legitimacy and widespread adoption.

### **3. Deficiencies in International Marine Pollution Control**

The success of international marine pollution control is a worldwide issue that is intimately tied to the sustainable development of the marine ecosystem and the long-term objectives of human society. Nonetheless, there are several glaring gaps in the laws and treaties that are now in place to address the issue of marine pollution, and these gaps have significantly limited the international community's ability to effectively manage marine pollution.

#### **3.1. Theoretical Issues with Current Legislation and Treaties**

One of the primary theoretical issues with current legislation and treaties is the lack of specificity and generality in legislative provisions. A frequent problem is that international treaties and legislation governing marine pollution are often too broad and non-specific [15]. For instance, despite the fact that all nations are required by the United Nations Convention on the Law of the Sea to protect and preserve the marine environment, there is a dearth of precise guidance regarding the operational procedures and implementation standards, which makes it challenging for nations to come up with a single standard of action for the implementation process. Because of this ambiguity, the law is far less enforceable and binding, and it is more challenging to create effective fines and limits on activity that contributes to marine pollution.

The absence of explicit international procedures for coordination and collaboration among nations is another issue with international maritime pollution control. Despite the fact that numerous treaties stress the value of international cooperation, nations frequently struggle to establish an efficient system for cooperation because of differences in their national interests, technological capacities, economic development, and other aspects. For instance, the international community's response to transboundary marine pollution incidents is frequently not swiftly enough or well enough coordinated due to unclear operational procedures and the division of roles for cooperation on emergency response, information sharing, and technical support. Collaboration is essential for the sustainable development of the oceans, as well as for modern global governance and the creation of an ocean community of destiny.

Furthermore, many areas need revision and the topic is only partially covered in these legal instruments; the current legal frameworks and treaties are insufficiently comprehensive when it comes to the administration of marine pollution. Many accords focus mostly on marine pollution from land-based sources, paying little attention to pollution caused by activities that occur at sea, like shipping and the exploitation of marine resources. However, there are currently no forward-thinking regulations or response strategies for emerging causes of marine pollution, such as the exploitation of seabed mineral resources and microplastic pollution, in the laws and treaties in place. The governance of marine pollution appears to be insufficient in the face of new issues as a result of this

lack of comprehensiveness, which makes it challenging to adjust to the requirements of marine environmental protection.

### 3.2. Practical Issues of International Ocean Governance

One practical issue is that the diversity and regional nature of provisions lead to a lack of uniform standards for implementation. Different regional plans or global treaties do not comprehensively cover all aspects, making it difficult for international organizations, like the United Nations, to enforce provisions in specific countries or regions uniformly. The Fukushima discharge highlighted this issue, as international nuclear safety standards lacked a certain international verification mechanism. Additionally, enforcement difficulties arise because non-global treaties often contain non-mandatory provisions, lacking specific rights and organizational structures for effective implementation [16].

Another issue is that some countries or regions lack the necessary conditions for treaty implementation. Certain countries or regions, particularly small island states and economically vulnerable countries, lack the institutions or authorities required to implement effective ocean management measures, as well as the conditions for implementation, such as a lack of experience, financial resources, and qualified personnel [17]. In the process of implementing the Treaty, it is necessary not only for the planning, deployment or technical resources of the relevant organizations, but also for the resources of the States parties themselves to ensure the realization of the purpose. However, uneven developments in related areas also hinder the process of cooperation and implementation.

Additionally, the tasks related to marine pollution control are often distributed among various departments and agencies that operate independently. Regional organizations and action plans typically require a comprehensive process, including situation analysis, technical analysis, plan formulation, task allocation, implementation, meetings, and monitoring. This creates a substantial workload, and the contradiction between limited staff and numerous tasks can slow down the implementation process, resulting in slow or ineffective outcomes.

Another practical issue lies in the distribution of governance responsibilities. International organizations have limits to their roles. While they cover many aspects and regions of marine pollution control, there are still areas that remain unmanaged. The planning and programs carried out by these organizations are often directional and long-term, focusing on leading multi-agent participation rather than on specific plans. States also face obligations and challenges in marine pollution control. Effective marine pollution control requires not only the leadership of international organizations but also the active participation and support of all countries. However, the numerous treaties and the involvement of many States create different responsibilities and obligations, leading to unclear national responsibilities and difficulty in achieving tangible results.

The private sector also plays a role, albeit smaller, in marine pollution control. Private entities should adhere to their respective national laws and treaties to protect the marine environment and control pollutant emissions. However, differences between domestic and international standards can make implementation challenging. Additionally, private entities might exploit governance loopholes to pursue economic interests, leading to negative behaviors that adversely impact the marine environment.

A lack of international cooperation further exacerbates these issues. Different regional action plans involve various actors with significantly different approaches, regulatory frameworks, and voluntary arrangements [18]. Similar regulations are frequently not well coordinated between nations, which leaves implementation gaps and widely differing standards. Except for those managed by or in cooperation with the International Environment Agency, there is less collaboration and higher independence among international and regional organizations, leading to inefficiencies. This makes

it challenging to improve the process and speed of marine pollution control, with management often lacking clarity regarding authority and execution.

#### **4. Construct New Countermeasures for International Marine Pollution Control**

##### **4.1. Enhancement of the Framework of International Law and Treaties**

In the formulation of the system of international law and treaties, consideration should be given to the addition of specific operational and procedural uniform provisions. The process should involve adding detailed measures and implementation rules to the existing provisions on marine pollution control. This would clarify what specific acts violate the provisions of the Convention, establish standards and rules for relevant actions, and outline specific responses to different types of marine pollution. Furthermore, it would define the responsibilities and obligations of each entity in addressing marine pollution.

To ensure the effective implementation of countries' climate change commitments, it is crucial to establish robust monitoring and enforcement mechanisms. Strengthened monitoring and enforcement mechanisms could accelerate the monitoring, reporting and verification of discharges of pollutants into the ocean, for example, and the adoption of corresponding legal measures against countries that fail to meet their emission reduction obligations [19]. Utilizing advanced science and technology for supervision is also important. Specific scientific and technological instruments should be used to test the ocean's ecological environment, water quality, and sewage discharge standards, as well as to monitor the marine pollution situation. This would allow relevant international institutions to promptly identify global marine pollution locations and address them through sub-regional jurisdictional solutions, thereby more effectively supervising the implementation of international marine pollution control treaties and agreements.

Additionally, harmonizing international standards for marine environmental pollution is necessary. Currently, there are too many international and regional organizations with varying pollution standards. Although there are treaties addressing pollution from multiple sources, they are often scattered or only apply to some signatory countries. Relevant international organizations need to unify these standards and ensure they are widely confirmed and recognized. Once pollution standards are unified across high-coverage areas of the world, such as those related to atomic energy, chemicals, oil pollution, and land pollution, it will be possible to hold different subjects accountable based on these unified standards. This would enhance the authority of relevant conventions and international organizations, providing a more cohesive and effective framework for managing marine pollution.

##### **4.2. Strengthen international cooperation and coordination mechanisms**

Marine pollution control is a global issue that requires a joint response from the international community. Strengthening international cooperation and coordination mechanisms is essential for effectively addressing this challenge.

It is essential to establish a unique mechanism for cooperation. Through knowledge and data portals, stakeholders should improve and exchange information about the condition of the ocean, current issues, legislative frameworks, development strategies, research findings, scientific and technological advancements, and experimental instances. Furthermore, within the current framework of global cooperation, climate change-specific mechanisms should be established to assist developing nations in tackling the problems of pollution in the marine environment and climate change. Examples of these mechanisms include climate change funds and technology transfer platforms.

Enhancing the depth and breadth of international cooperation is also necessary. While there is already significant international cooperation, it should be deepened and broadened to address existing problems more effectively. In-depth cooperation involves closer communication, greater trust in

exchanging and discussing relevant monitoring data, scientific research information, and other marine pollution control content, thereby improving governance efficiency. Extensive cooperation, such as strengthening dialogue and cooperation among countries on global marine pollution control issues through multilateral platforms, and jointly discussing and formulating strategies and measures to address climate change, covering more countries and regions. There should also be increased information exchange and communication between the action plan and the organization, and joint governance should be achieved to achieve the purpose of cooperation.

Promoting multi-agent co-governance is vital. International organizations, national entities, enterprises, and individuals should all participate in the control of marine pollution. The global marine pollution problem affects everyone's life and health, and the collaboration of multiple entities can improve the marine environment most efficiently and effectively. International organizations should update their plans according to the latest marine pollution control situation, and national entities should participate in and appropriately adjust relevant domestic laws and regulations in accordance with the direction of international treaties. This will enhance consistency and facilitate joint implementation and enforcement both domestically and internationally. Enterprises should comply with the adjusted laws and regulations, transitioning to greener and safer production and emissions practices to reduce the negative impact of pollutants on surrounding waters and human health. For the public and individuals, awareness of marine pollution control should be raised, and healthy and sustainable choices and consumption should be encouraged. Public participation can also provide evidence for policy decision-making and regulatory activities, helping to promote the optimization of marine pollution control at the next level through collective efforts in supervision and evidence collection.

#### **4.3. Strengthen the Mechanism for Assessing Pollution Damage and Pursuing Responsibility**

Strengthening national accountability is crucial, given the current status of legal treaties. Due to the generality of global legislation and the soft law nature of regional legislation, it is challenging to allocate and clarify governance responsibilities. A significant portion of implementing international obligations does not directly apply the rules of "global obligations", but instead, needs to be integrated into the domestic laws and policies of various countries. International law does not mandate provisions for marine pollution control in specific countries, implying that states hold substantial responsibility for marine pollution. Most of the international conventions and regional action plans are concluded on a national basis, with states as the main implementers. Therefore, it is essential to focus more on state responsibility. Strengthening supervision and accountability of pollution emissions across countries involves overseeing the national implementation process and clarifying compliance requirements and violations. This will enhance the country's sense of responsibility for the marine environment and ensure prudent implementation of state actions.

Improving the mechanism for assessing and compensating for pollution damage is also necessary. The United Nations Convention on the Law of the Sea serves as a representation of current marine pollution rules and regulations, which are very vague and lack precise provisions for damage assessment and compensation systems. Establishing unified pollution assessment standards would ensure fairness and feasibility in assessing pollution damage. These standards would define damage assessment procedures based on specific behaviors and conventions, considering the scope and degree of damage. The compensation mechanism, whether economic compensation or ecological restoration, should be based on the results of the damage assessment. Only by establishing specific damage compensation and assessment mechanisms can we enhance the sense of responsibility of all entities towards the marine environment, jointly protect it, and participate effectively in marine pollution control.

It is imperative to foster global legal and arbitration systems in order to enforce rules and regulations and guarantee that various topics comply with them. The International Tribunal for the Law of the Sea currently handles disputes pertaining to international maritime pollution; nevertheless, the majority of cases do not directly address marine pollution control, indicating a deficiency in procedural guidelines and their application. Strengthening international judicial and arbitration mechanisms can ensure efficient, fair, and rapid resolution of governance issues. Relevant international organizations should include procedural provisions to address violations of marine pollution control treaties, utilizing international judicial and arbitration institutions to resolve related problems effectively.

## 5. Conclusion

Through the analysis of the Fukushima pollution incident in Japan and the literature on related marine pollution, it is evident that international marine pollution control faces both theoretical challenges with existing laws and treaties and numerous practical issues in international marine governance. Theoretical problems include the lack of specificity and clarity in international treaties, making it difficult to implement and enforce regulations effectively. Furthermore, there are a number of serious holes in the governance system, including insufficient measures for international cooperation and coordination, which result in disparate and inconsistent methods of controlling marine pollution. These shortcomings draw attention to the necessity of a more thorough and well-organized legislative framework that can handle the intricacies of maritime pollution.

This paper argues that future legislation should focus on clarifying specific measures and accountability systems within international laws and treaties to ensure effective marine pollution control. Strengthening the responsibilities of international organizations and individual countries is crucial for achieving this goal. Enhancing international cooperation and governance mechanisms will facilitate better coordination and collaboration, addressing the multifaceted nature of marine pollution. Additionally, improving pollution damage assessment and establishing robust compensation mechanisms are essential steps to ensure that all entities are held accountable for their actions. We can continuously enhance the worldwide response to marine pollution control by addressing these theoretical and practical concerns, assuring both the long-term viability of human society and the sustainable development of marine ecosystems.

## Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

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