

Attribution of Liability in Transboundary Water Pollution Incidents

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Abstract

The issue of attribution of liability for transboundary water resource pollution involves a large number of stakeholders. It is necessary to analyse the ambiguities in the liability in the light of the legal basis and the practical orientation, and to find a way forward to improve clarity and enforceability. It is crucial to clarify the liability and compensation mechanism, which not only needs to follow the basic principles of international environmental law, such as common but differentiated responsibilities and sustainable development, but also draws on international treaties and judicial practice. Besides, At the same time, it is also important to pay attention to the fact that China has already gained some influence in the international community in the area of liability determination for transboundary water pollution, including the management of transboundary water resources based on sovereignty and co-operation, the construction of a legal system using a combination of soft and hard law, and the establishment of an ecological compensation mechanism. In order to enhance the clarity and operability of international liability norms in line with the international process, China can refer to international practices and achieve its goals by promoting transboundary water resources cooperation, strengthening legal enforcement and cross-border accountability, and improving emergency preparedness and liability implementation.

Keywords : International water law; Transboundary water resources; Transboundary environmental damage; State responsibility

Suggested citation : Ren, Z. (2025). Attribution of Liability in Transboundary Water Pollution Incidents. *Journal of Current Social Issues Studies*, 2(5), 297–305. <https://doi.org/10.71113/JCSIS.v2i5.273>

Introduction

Necessity for protection based on the legal attributes of transboundary water resources

Transboundary water resources, in the form of rivers, lakes and groundwater systems, cross national borders and have a global impact on ecosystems, economic conditions and public health and safety. Such water bodies, such as the Nile, the Amazon and the Mekong, are rich in political, economic and socio-cultural values, and are indispensable for agricultural and industrial production and daily life, as well as for the preservation of biodiversity.

However, transboundary water resources involve various fields, including politics, society, jurisdiction, physical, ecological, and biochemistry, which determines the particular complexity of the issues of allocation, supply, demand and utilization management of transboundary water resources. (Yifei Zhang, et al., 2024). The 1992 "Convention on the Protection and Use of Transboundary Watercourses and International Lakes" explains the regulation of transboundary impacts, which emphasizes preventing, controlling, and ensuring the fair and reasonable use of transboundary water resources. Concerning transboundary pollution, the high mobility of water resources, their wide distribution, and their shared nature pose even greater risks to the public health and ecological balance of affected countries. Pollution from industries, agriculture, and domestic activities entering a shared watershed does not respect national boundaries, creating a more complex situation for managing water pollution. These pollutants can degrade water quality, threaten aquatic ecosystems, affect human health, and cause long-term ecological damage. Moreover, the economic and technological disparities between countries mean that the consequences of pollution are unevenly distributed, with downstream countries often bearing a greater burden due to upstream pollution activities.

Significance of clarifying liability and compensation mechanisms

The relationship between human rights and sovereignty is inseparable, and protecting human rights does not limit the essence of national sovereignty (it limits the dynamic attributes of sovereignty)(Canling Lin, 2019). Transboundary water resources possess a multilevel tenure system. From the perspective of international water law, this requires recognizing the sovereignty issues of transboundary water resources and defining ownership, usage, and distributive rights at different levels among the sovereign states sharing the river basin(Zhixuan Zhao, 2018).

Sovereignty is not only a nation's right but also a concept of national responsibility. Since pollution often spans multiple borders and involves various actors, clarifying state responsibility is essential to ensuring fair treatment for affected countries at different levels of rights. On the one hand, this avoids long-term disputes caused by unclear or deflected responsibility; on

the other, it provides legal protection to affected parties and promotes timely corrective actions. Pollution incidents not only cause environmental damage but also economic losses and social impacts, potentially triggering cross-border agricultural production, fisheries crises, and public health issues. Therefore, constructing a clear compensation mechanism to ensure that affected parties receive economic compensation and ecological restoration is vital for achieving environmental justice and restoring ecological damage.

The Legal Basis and Practical Orientation for Determining Liability in Transboundary Water Pollution

Definition of Liability for Transboundary Water Pollution

Transboundary water bodies often span multiple national political boundaries and have shared and public characteristics. Their management and protection face complex legal challenges, particularly concerning pollution, over-exploitation, and ecological destruction. Defining liability for environmental damage to transboundary waters has become a key issue in international law. This requires a solid foundation in international environmental law's fundamental principles, exploring feasibility and general trends through international treaties and judicial practices.

Liability for transboundary water pollution refers to the responsibility for pollution that occurs as a result of the actions of one or more countries in the use, management, and protection of transboundary waters. This includes state liability and corporate responsibility. For example, when activities within a state's jurisdiction, such as pollution or exploitation, lead to cross-border damage to the water resources and ecosystems of neighboring states, the responsible party must bear compensation and restoration duties.

In general customary international law, the liability of a State for transboundary water pollution depends mainly on the failure to fulfill the duty of care and diligence, the existence of objective fault, and the violation of treaties. For example, Japan, as a State party, has signed a series of international treaties, including the "United Nations Convention on the Law of the Sea" and the "Convention on Nuclear Safety". On the issue of nuclear sewage discharge, its decision is suspected of violating the core obligations to protect and preserve the marine environment and to prevent the spread of pollution under the "United Nations Convention on the Law of the Sea", etc. If Japan's nuclear sewage discharge into the sea poses a great danger to all mankind as well as to the marine environment, the international community is justified in believing that Japan may be in breach of the customary international law "Obligation Erga Omnes" obligations (Huanxin Luo, 2021). The "Obligation Erga Omnes" relates to the common interests of the international community as a whole or of members of a collective. Rather, the concept of community interest, which reflects the common or fundamental values of the international community, is a key element of the "Obligation Erga Omnes" (Yuanyuan Li & Yan Zhang, 2023). This is because such behavior not only affects the specific interests of the neighboring countries, such as the marine environment, fishery resources, and public health, but also poses a potential threat to the global ecological balance, the common environmental interests of mankind, and the rights and interests of future generations, and involves significant interests of concern to the international community as a whole.

Scope of Liability for Transboundary Water Pollution

Transboundary water pollution involves various types of pollution sources, including industrial wastewater discharges, agricultural runoff, domestic sewage, chemical substance spills, etc., which may lead to water quality degradation, destruction of aquatic ecosystems and public health crises when they enter other basins. According to the principles of international law, the source country of pollution should bear the "preventive responsibility" and "remedial responsibility" for the transboundary water pollution caused by it, and the so-called "preventive responsibility" means that the source country of pollution needs to proactively take all kinds of preventive and control measures before pollution occurs, so as to reduce the possibility of pollution occurring. In the field of ecological and environmental governance, the concepts and systems of damage prevention and risk prevention have never been lacking. It can be said that ecological environment legislation is inherent with damage prevention and risk prevention "gene" (Xianjing Wu, 2024); whereas "remedial liability" requires the source country of pollution to assume the corresponding liability and the obligation to repair the damaged ecology after the pollution has occurred, which belongs to the remedial measures after the fact.

Pollution not only adversely affects the natural functions of water bodies, but also causes long-term and incalculable economic losses to communities and countries that depend on water resources for their survival and development. In view of the cumulative and long-term nature of the pollution problem, countries in the development and utilization of water resources, should strictly adhere to the rational use and fair distribution of the basic norms, to effectively avoid over-exploitation or irrational development of a country's neighboring ecological environment suffered irreparable damage results.

With regard to the determination of specific liability, it is generally necessary to make a comprehensive judgment based on causality, with the main factors of consideration including whether the pollution or damage was triggered by the specific acts of a country, the actual extent of the damage and the scope of its impact, as well as the obligation of the responsible country to prevent pollution, etc.; and the establishment of a mechanism for compensation, including economic compensation, ecological restoration, and compensation for communities in the affected areas, etc.

Basic Principles in International Environmental Law

Since there are differences in economic development, political systems and technical resources among countries, the allocation of responsibilities needs to be considered equitable. Developed countries, with their strong economic and

technological foundations, have greater capacity and resources to deal with transboundary water pollution. Developing countries, on the other hand, often rely on resource development and industrial development paths in their development process, and face the dual problems of technological bottlenecks and lack of financial resources in the field of environmental monitoring and pollution control. Adopting a uniform standard of liability may be too harsh for developing countries.

Instead, the principle of common but differentiated responsibility allows for the allocation of responsibility in accordance with the actual capacity of each country, and the concept of "common responsibility" proclaimed by the Stockholm Conference on the Human Environment in 1972 is a preliminary form of the principle of common but differentiated responsibility; "differentiated responsibility" allows countries to allocate responsibility in accordance with their own practical and developmental needs. The concept of "differentiated responsibilities" allows countries to define specific tasks in accordance with their national realities and development capacities, so as to avoid shirking responsibilities and imbalances in international cooperation and to work for the common good. As early as the 1992 Framework Convention, the original purpose of the principle of common areas manifested the spirit of the value of equity. Whether the principle can continue to gain universal acceptance and adoption, and achieve environmentally effective implementation depends on whether the basis of responsibility is established fairly and equitably while responding to the dynamically changing international situation (Chen Zhou, 2023). Transboundary water resources should have the legal attribute of "shared natural resources" in addition to the natural attributes of mobility, wholeness and circularity (Lili Shao, 2017). Based on common natural resources or interest claims, the theory of community of interest of riparian/basin states, or common resource/interest theory, has emerged in international water law (Yanmei He, 2007). For transboundary water, if justice is to be distributed among basin countries, the first step is to regard the basin as a common resource, and then to distribute the benefits of basin utilization in accordance with the procedure of justice, therefore, the theory of justice, which is the most original theory of jurisprudence, constitutes the jurisprudence theoretical foundation of the community of interest theory (Desheng Hu, 2018). The 1997 "Convention on the Law of the Non-navigational Uses of International Watercourses", on the other hand, supported by the theory of common interests, tries to resolve disputes through the management of common property and the sharing of revenues by downplaying the sovereignty and failing to clarify the nature of the transboundary water resources belonging to the situation, and these provisions have been utilized in practice, and the reason why it can resolve the disputes essentially lies in the fact that the sovereignty of the transboundary water resources, a common property, is clarified in the respective riparian countries to clarify (Lili Shao, 2017). The principle of sustainable development has been implemented in the context of environmental protection and economic development, and the common interests focusing on the rational exploitation and protection of multiple interests in water resources.

The principle of sustainable development is consistent throughout the entire process of environmental protection and economic development, with the key to achieving synergistic development of the economy, society and the environment, maintaining intergenerational equity, and ensuring that future generations will have clean and abundant water resources. In the process of national economic development, the environmental and socio-economic impacts of transboundary water pollution on other countries must not be overlooked, and enterprises should not sacrifice the environment for short-term profit gains in their overseas investment and trade activities. In the determination of liability for transboundary water pollution, countries need to weigh the relationship between economic development, social stability and environmental protection, rationally allocate responsibility, and actively encourage the adoption of comprehensive programs that can reduce water pollution, promote economic development and social progress.

Liability Determination in International Practice

The Polluter Pays Principle of the EU legal system for water pollution control is gradually being extended to many areas of environmental management in Europe. The Polluter Pays Principle advocates that after an accident occurs, the polluter should pay for the control, removal and protection measures of the pollution in order to promote the internalization of economic costs (Canling Lin, 2019). The original intention of this principle is to let the polluting enterprises bear the cost of pollution control due to production activities, which not only fits the public's call for the burden of pollution control costs, but also the state, through the environmental tax levied on enterprises, on the one hand, clarifies the responsibility of enterprises for the control of pollution, and on the other hand, mobilizes a large amount of funds for environmental protection and control (Cunfan Ding, 2020). Clearly define the "polluter" definition standard covers enterprises, investors, traders and other multiple subjects, and each subject in different pollution scenarios bear differentiated responsibilities. In the face of complex situations such as intertwined multiple sources of pollution or long-term cumulative pollution, it is possible to combine the causation criteria, including direct and indirect causation determination. Direct causation means that a certain behavior directly leads to water resource pollution; indirect causation needs to integrate a variety of factors to accurately judge the responsible subject, such as the contribution of different pollution sources, time sequence, spatial diffusion path, etc.

At the practical level, in typical incidents such as oil spills and radioactive waste discharges, liability is usually attributed to the operator. For example, in the general principles of nuclear liability set out in the "Vienna Convention on Civil Liability for Nuclear Damage", it is stated that the basic principles on which the special nuclear liability regime is based include references to "absolute" liability, i.e., no-fault liability, and the exclusive liability of the operator of the nuclear installation, which reflects a regime of strict liability that shifts the responsibility to the operator who has caused the contamination. The liability is shifted to the operator who caused the pollution. By analogy with the production activities of enterprises, enterprises that pollute water resources by discharging wastewater in the course of production should bear the corresponding costs of remediation on the basis of the polluter pays principle.

However, due to the extended and holistic nature of cross-border pollution, which cannot be characterized in time and space within a short period of time, most of the tangible and intangible damages caused by cross-border pollution are not instantaneous, but need to be accumulated year by year before they can be fully released. Relying solely on such strict liability may extend the liability of the polluter indefinitely, and therefore, in the case of bilateral and multilateral transboundary pollution, it is also necessary to consider the synergy between joint liability and payer compensation mechanisms.

According to the principle of prevention of damage, even in the absence of scientific certainty, effective and costly precautionary measures should be taken to prevent the risk of environmental damage, scientific uncertainty cannot justify the failure to take measures (Weichun Chen, 2018). In developing and utilizing its indigenous natural resources, a state should consider its existing or future impacts on the environment outside its jurisdiction within its sovereign jurisdiction, while taking appropriate measures to prevent transboundary pollution while formulating substantive and procedural rules for environmental protection (Lili Shao, 2017). As the Pulp Mills on the River Uruguay judgment had shown, the Court had gone a long way towards clarifying the nature and scope of the obligations relating to the prevention of transboundary harm, in particular the duty of due diligence owed by watercourse States. The Court held that the duty of prevention could be divided into procedural and substantive due diligence requirements, the procedural requirements being based on early notification and consultation, and the substantive requirements being the development and effective implementation of appropriate domestic legal controls over the extraction, pollution and protection of shared watercourses and their associated ecosystems, which imposed a full range of pre- and post-commitment requirements on the perpetrator to proactively prevent and respond to pollution and to minimize harm.

Legal Norms in International Treaties

Bilateral agreements based on treaties can significantly curb unilateral actions. By clearly defining the responsibilities, obligations, and corresponding measures of both parties, these agreements help establish unified governance rules, which have a positive effect on addressing environmental pollution at the borders (Xuyu Hu, 2013). The 1997 "Convention on the Law of Non-Navigational Uses of International Watercourses" is one of the cornerstones of transboundary water resource management. It emphasizes that when states develop or use transboundary water resources, they must consider the interests of all the countries involved, avoid over-exploitation or misuse, and ensure the sustainable use of shared resources. The dual principles of "equitable and reasonable utilization" and "no significant harm" have been established.

In regional agreements, such as the "Convention on the Protection of the Marine Environment in the Baltic Sea Area of 1992" in Europe and the "Agreement concerning the Niger River Commission and the navigation and transport on the River Niger" in Africa, member countries cooperate and coordinate the management of shared water resources. These agreements, particularly in terms of pollution prevention and emergency response, provide clear legal guidelines for informing affected parties, cooperation mechanisms, and liability for compensation. The "Uruguay River Pulp Mills Case" demonstrated that regional treaties, such as the "Statute of the River Uruguay (1975)", could serve as the basis for the International Court of Justice to determine the Uruguay River's management responsibilities and whether Uruguay met its notification obligations (Shicun Wu, 2020). These international documents emphasize the prevention and control of transboundary water pollution through international cooperation, which, together with State practice and the development of international environmental law, has contributed to the formation of the law on transboundary water pollution prevention and control and has become an important part of international water law, facilitating the establishment of bilateral or multilateral specialized pollution prevention and control management regimes in many transboundary basins. (Yanmei He, 2007).

Ambiguities in Determining Liability for Transboundary Water Pollution

Differences in Legal Interpretation and Application

While international practice provides a standard framework for liability determination, there are numerous challenges in enforcing international agreements due to differences in national laws, policies, and interests. These challenges become particularly evident when regional and global environmental agreements have differing provisions. Coordinating these differences is one of the central difficulties in determining responsibility, as achieving consensus through international cooperation is a complex and time-consuming process. It not only requires legal and diplomatic efforts but also involves political and economic considerations. The many uncertainties that arise in the process often slow the progress of state responsibility determination, leaving room for states to shift or avoid responsibility.

Although core principles of international water law, such as "equitable and reasonable use" and "no significant harm", are widely recognized, their legal connotations and implementation guidelines lack clear and specific definitions, which exacerbates distrust between nations. This is because countries differ in their standards and enforcement mechanisms, which can lead to inconsistent applications and interpretations of international norms. Additionally, the emphasis placed on the two principles varies, with upstream countries often favoring the "equitable and reasonable use" principle to support their development activities, while downstream countries may rely on the "no significant harm" principle to oppose development. As a result, there has been ongoing debate about whether one principle is subordinate to the other and which principle should take precedence (Qian Wu, 2021).

In the enforcement of international water law, many countries, deeply concerned about national sovereignty, tend to reject international jurisdiction, fearing that following international environmental law or accepting international rulings could undermine their autonomy over natural resource management and policy-making (Philpot D. & Wei Yi, 2018). This resistance

is particularly strong when international environmental regulations might negatively impact a country's economy. For example, some countries may be concerned that adhering to international environmental laws would severely impact their mining industries, increasing costs and reducing production, thereby affecting national income and employment (Agaraj X., 2011).

Force Majeure and Multi-Entity Responsibility Factors

If an event is proven to have been caused by unforeseeable, unavoidable, and insurmountable external factors, an argument of force majeure can be accepted as a defense (Saul R., et al., 2016). However, if the force majeure event is fully or partially caused by the state invoking this defense, the force majeure argument cannot be invoked. Determining the specific impact of force majeure events on water pollution often requires rigorous scientific analysis and substantial factual evidence (Jinpeng Wang, Lulu Jiang, 2023). This makes it particularly difficult to establish causality, as it is necessary to distinguish the environmental impact of human activities from that of force majeure factors. Moreover, water pollution cases often involve multiple parties and numerous contributing actions, which complicates the distribution of liability. It is not only necessary to assess the relative responsibility of each party but also to consider the direct consequences of their actions. This complexity makes liability determination extremely challenging, as many interconnected factors increase the difficulty of resolving the issue.

Although international environmental law has established broad principles for preventing, reducing, and controlling pollution, as well as ensuring the sustainable use of water resources, it often lacks specific guidance on addressing complex pollution situations involving multiple factors. This lack of clarity leads to uncertainty in enforcement and compliance. When multiple parties are involved in pollution incidents, it becomes difficult to pinpoint the specific impact of each source, further complicating the determination of legal responsibility and the implementation of remediation measures (McIntyre O., 2017).

Conflicts in International Jurisdiction and Applicable Law

In cross-border water pollution cases, jurisdictional conflicts are inevitable due to the involvement of multiple countries, each with its own legal system and environmental regulations. International practice tends to address conflicts by harmonizing substantive laws, rather than resolving jurisdictional and applicable law conflicts. For instance, Principle 22 of the Stockholm Declaration (1972) states, "States shall co-operate to develop further international law regarding liability and compensation for the victims of pollution and other environmental damage caused by activities within the jurisdiction or control of such States to areas beyond their jurisdiction".

Current international practice designates the modalities that may be used to resolve certain specific types of transboundary pollution disputes, such as the "Paris Convention", which in the case of nuclear pollution allows actions to be brought only in a Contracting State or in the State where the accident took place; and in the case of oil pollution, the "Brussels Convention", which limits the action to the territorial limits of the Contracting State or Contracting States in which the damage occurred. In the field of international water law, there was a lack of guidelines that could be used to resolve conflicts of jurisdiction. Conflicts could arise when different States asserted jurisdiction on different legal bases, such as the place of pollution, the nationality of the polluter or the location of the source of pollution. Diverse jurisdictional claims complicate the overall legal environment, leading to disputes over applicable law and jurisdiction, which in turn leads to inconsistencies in adjudication and enforcement. Even when jurisdiction is successfully established, its enforceability may face many limitations. This is mainly due to the fact that States have incorporated environmental law into their domestic legal systems in different ways and that agreements often do not provide for the proper resolution of conflicts between different legal systems, leaving room for interpretation and application.

Owing to the inadequacy of formal legal avenues, many transboundary environmental issues may also be resolved through diplomatic rather than legal channels. Diplomatic solutions have the advantage of taking into account the amity of countries and the interests of all parties, but the disadvantage is that it is difficult to determine the applicable rules, and if only negotiated between the two parties, it is difficult to avoid the strong countries overpowering the weak ones, or even making the results biased in favour of the interests of the strong countries, which is unfair (Hong Zhao, 2023). This may lead to a tendency to politicize environmental issues and deviate from the scientific track, which is not conducive to the proper handling and effective management of transnational water pollution problems.

China's Approach to Determining Liability for Transboundary Water Pollution

The Legal Foundation of Sovereignty and Cooperation in Transboundary Water Resources

China's legal regulations and practices regarding liability determination for transboundary water pollution cover several aspects, including international river management, state sovereignty protection, liability for industrial water pollution, and the application of soft law in water resource management. However, a single nation cannot independently address the challenges posed by transboundary water resources. Therefore, China actively advocates for extensive cooperation and consultation with neighboring countries to ensure the efficient and sustainable use of transboundary water resources. In managing transnational river basins, China consistently prioritizes cooperation and consultation, striving to achieve equitable distribution of resources and balance the interests of both bilateral and multilateral stakeholders.

"Sovereign ownership" and "common interest theory" are central to the legal framework governing transboundary water resources. In the process of managing and utilizing transboundary water resources, each state must respect the sovereignty of others and rely on cooperation to achieve shared interests. The Lancang-Mekong cooperation mechanism, for instance, serves

as a platform for China and downstream countries to jointly manage and utilize the Mekong River's water resources. This framework comprehensively regulates the rights and obligations of riparian states, balancing the rights and obligations of upstream and downstream countries, thereby creating a more orderly system for water resource development and utilization to protect the ecological and environmental interests of the Lancang-Mekong Basin (Yongmei Chen, Youfang Guo, 2023). The common interest theory must emphasize the rightful interests of each riparian state based on the clarified nature of sovereign ownership of transboundary water resources to achieve justice in water resource distribution (Lili Shao, 2017). The theory requires that, in allocating responsibilities, we do not rely solely on one factor but instead comprehensively consider the roles and capacities of all parties involved in the utilization of water resources. This approach ensures that responsibility allocation is fair, reasonable, and practically implementable. In this process, not only the responsibility of polluters must be considered, but also the responsibility of affected countries in pollution prevention, implementing response measures, and maintaining regional interests.

Application of soft law in the determination of liability for transboundary water pollution

International soft law primarily manifests in non-binding legal documents adopted by international organizations and multilateral diplomatic meetings, including declarations, resolutions, guidelines, or codes of conduct (Wei Shen, Shuo Feng, 2022). Examples include the "Agenda 21" from the United Nations, draft convention proposals from expert groups, and bilateral and multilateral agreements signed between states and regions, along with cooperation mechanisms. These soft law documents are non-binding but are flexible enough to be adjusted in response to the dynamic changes in regional water resource management needs. The flexibility and guidance of soft law help facilitate intergovernmental cooperation, creating a more orderly framework for regional cooperation (Youqi Shi, Weiwen Zheng, 2022).

For example, within the Lancang-Mekong cooperation mechanism, the soft law documents developed by participating countries, though non-binding, establish a common framework that promotes information sharing, technical exchange, and policy coordination. This has significantly reduced barriers to cooperation and increased the efficiency of addressing transboundary water pollution. However, in matters of determining compensation liability and enforcing legal responsibility, soft law's non-binding and ambiguous nature cannot provide precise or authoritative grounds. In such cases, hard law, with its clear legal provisions, rigorous responsibility standards, and state enforcement, offers a solid legal foundation and institutional framework for implementing soft law. China's hard law system, such as the "Water Pollution Prevention Law" (2017 amendment) and the "Environmental Protection Tax Law" (2018 amendment), reflects the "polluter pays" principle, specifying that polluters must bear responsibility for the damage caused to water resources. This includes taking effective measures to control and eliminate pollution and compensating for all direct and indirect losses caused by pollution, ensuring authoritative legal determination and enforcement of liability through national authority.

Ultimately, soft law provides practical experience and theoretical foundation for hard law, and its standards and guidelines, once tested in practice, can be integrated into hard law systems. Simultaneously, hard law provides the legal basis and institutional security for the application of soft law. Together, they complement each other, building a comprehensive legal system for determining liability for transboundary water pollution. The simultaneous use of both soft and hard law and cooperative governance will be the future path for regional intergovernmental cooperation (Youqi Shi, Zhikun Yang, 2018). This will ensure the necessary legal support and institutional guarantee for the reasonable protection and sustainable use of transboundary water resources.

Ecological Compensation in the Construction of State Responsibility

In addressing transboundary water pollution, China supports a state-led compensation responsibility system, which not only compensates for damages caused by polluters but also includes mutual compensation between affected countries. The core principle of the ecological compensation model is "beneficiary pays," which is an extension of the "polluter pays" principle. This principle requires that countries benefiting from the development, utilization, and ecological conservation of transboundary river resources must compensate the countries that carry out conservation and environmental protection efforts for these shared water resources (Tianbao Qin, 2021). The determination of compensation responsibility for transboundary water pollution highlights both state responsibility and shared responsibility, advocating for international cooperation to strengthen preventive and compensatory measures. As a member of the international community, China must also shoulder certain compensation responsibilities in transnational river basin management and global issues such as climate change (Qingjun Wang, 2023). Currently, China and some neighboring countries have engaged in water resource cooperation, establishing dialogue platforms and execution agencies in most transboundary river basins to support ecological compensation mechanisms for water distribution.

Enhancing the Clarity and Operability of International Liability Norms

Promoting Regional Cooperation and Diplomatic Negotiation on Transboundary Water Resources

In the context of transboundary water pollution, the international legal system provides an effective framework for resolving disputes over the use, management, and protection of shared water resources. The International Court of Justice plays a crucial role in resolving legal disputes between states, offering important legal foundations for preventing environmental damage, defining state responsibility, and determining compensation for pollution. Although decisions by international courts do not always lead directly to economic compensation, they advance the development of international environmental law by

establishing fundamental principles of state responsibility, prevention measures, and international cooperation. As global environmental issues continue to evolve, the role of the International Court of Justice in ensuring state accountability for transboundary pollution will remain a core element of the international environmental governance system, and its precedents should be referenced by states when determining responsibility.

Early transboundary water pollution management systems focused on passive control or "case-by-case" solutions, which were ineffective until the influence of ecological science and international environmental law spurred the adoption of ecosystem-based approaches (Yanmei He, 2020). For example, the Montara oil spill and the Danube cyanide leak cases highlighted the importance of cooperative management in shared water resources, stressing the obligation of states to work together in managing and protecting these resources.

China can promote effective management by establishing robust cross-border environmental cooperation mechanisms, conducting joint monitoring and environmental impact assessments, and ensuring that pollution issues are effectively prevented during transboundary water resource development (Zewei Yang, 2023). China could consider exploring cooperation mechanisms or pathways with ASEAN countries in areas related to marine environmental protection under the "Declaration on the Conduct of Parties in the South China Sea (DOC)" and other marine environmental fields. Specific measures could include establishing evidence collection teams of experts to conduct real-time monitoring of marine environments, expanding water quality sample selection, and maintaining evidence and testing data for future legal action (Bangda Hu, 2024). In addition to technical measures, diplomatic negotiation should be incorporated as a conflict resolution tool. It is the most advantageous approach for resolving disputes while respecting the sovereignty of all parties and avoiding conflicts (Hang Zeng, 2019). When countries have disagreements over responsibility and interests, negotiation offers a platform for dispute resolution, saving costs and preventing escalation (Qingjun Wang, 2024).

Strengthening Legal Enforcement and Cross-Border Accountability

The decision of the International Court of Justice emphasized the obligation of States to prevent significant harm to the water resources of neighbouring States. In the Pulp Mills on the River Uruguay case, the Court ruled that Uruguay had violated its obligation to prevent transboundary harm under international law by failing to effectively assess the potential environmental impacts of its project on shared water bodies. When addressing transboundary water pollution, China should clearly define the responsible parties and vigorously strengthen the legal scrutiny and supervision of enterprises and projects that may cause transboundary pollution. For example, when water resources development activities in upstream countries pose a potential risk of contamination of water bodies in downstream countries, it is important to clarify liability through legal means and actively implement preventive measures to prevent pollution.

In handling transboundary water pollution incidents, the scope of compensation should not be limited to the costs of environmental restoration, but should also include the economic losses and ecological restoration costs arising from pollution. At the same time, the relevant compensation mechanism should be flexible and operable, so as to ensure that the compensation can be provided in a timely manner, and to prevent the delay of compensation from triggering negative social sentiments and even conflicts between countries. By effectively increasing the strength of the implementation of domestic environmental laws and regulations, to ensure that in various types of cross-border pollution cases can be effectively held accountable. Therefore, when dealing with cross-border water pollution cases, we should not only rely on the framework of the international legal system, but also give full play to the functions of domestic law enforcement departments, so as to promote the strict compliance of domestic enterprises and government agencies with environmental protection standards, and to effectively fulfill their international responsibilities and obligations.

Improving Emergency Preparedness and Responsibility Implementation

In the construction of the mechanism for recognizing and managing transboundary water pollution liability, international water law has demonstrated its comprehensive and systematic character. It not only covers the core aspects of preventive measures, emergency response and liability, but also accurately clarifies the legal responsibilities and action guidelines of various countries. For example, in the Montara oil spill incident, the Montara Commission of Inquiry report pointed out that there were major deficiencies in the company's procedures, and the failure to comply with reasonable oilfield operational practices was the main cause of the blowout. There was also negligence on the part of the regulator, as in the case of the Northern Territory Department of Resources, which made significant errors in approving drilling procedures and failed to ensure that the company's procedures complied with statutory standards of good oilfield practice. As far as preventive measures are concerned, the core lies in the effective control of industrial discharges, agricultural runoff and other sources of pollution through scientific and rational planning and rigorous and efficient management, so as to prevent the growth and spread of transboundary water pollution from the source. As for the emergency response mechanism, in the event of an environmental incident that may have a serious impact on the waters of other countries, the responsible country is obliged by law to immediately notify the affected country and to take urgent measures in cooperation with the affected country to minimize the scope and extent of environmental damage.

For China, the Montara incident offers critical insights into enhancing transboundary water pollution governance. In constructing monitoring systems, it is imperative to establish a comprehensive and efficient framework to ensure timely and precise detection of pollution, thereby providing a robust scientific basis for accountability. When implementing mitigation measures, cross-border impacts must be rigorously evaluated through scientific data analysis to inform evidence-based decision-making. Concurrently, real-time monitoring of intervention efficacy should be prioritized to enable agile strategy

adjustments in response to evolving scenarios. Strengthening emergency preparedness is equally vital. This involves developing standardized contingency plans and institutionalizing emergency response protocols to address sudden pollution events. Upon an incident, immediate preventive measures must be activated, coupled with coordinated communication among stakeholders. Predictive modeling of pollution trajectories—including spatial extent, temporal progression, and contamination severity—should guide downstream nations in preemptive risk mitigation, ensuring systematic crisis management. (Guanwen, Tan, Tingting, Wei, 2024). On the issue of compensation for cross-border water resource pollution, the standards and methods of loss assessment should be clarified, the burden of proof should be reasonably distributed, and the assessment of potential losses such as ecological damage should be strengthened to ensure that the victims can obtain reasonable compensation, and thus promote the effective development of cross-border water resource pollution control.

Conclusion

The attribution of liability for pollution of transboundary water resources is multidimensional in character. Transboundary water resources, by virtue of their wide distribution and shared nature, have a profound and lasting impact on the ecosystems, economic development and social well-being of many countries. Clarifying the attribution of responsibility and constructing a scientific and reasonable compensation mechanism are the core of realizing the sustainable use of transboundary water resources and guaranteeing environmental justice. From the legal basis and practice-oriented point of view, the current definition of liability for transboundary water pollution is hindered at the level of legal interpretation, multi-entity and jurisdiction. However, the basic principles of international environmental law have always provided the fundamental basis for the allocation of liability, while the principles of polluter pays and damage prevention have played a key guiding role in defining liability in practice. Numerous international treaties and organizations played an active and irreplaceable role in regulating the determination of liability and promoting international cooperation.

China has been active in the area of liability determination for transboundary water pollution, carrying out transboundary water resource management on the basis of the legal principles of sovereignty and cooperation, and constructing a legal system for liability determination by means of a combination of soft and hard laws, which has given a strong impetus to regional inter-governmental cooperation. At the same time, China has actively advocated a state-led ecological compensation mechanism, which has achieved certain milestones, but still faces challenges in technical support and other aspects. In order to enhance the clarity and enforceability of international liability norms, China should proactively promote cross-border water resources cooperation and diplomatic negotiations, strengthen joint monitoring and environmental impact assessment, and flexibly and skillfully use negotiation means to resolve disputes; strengthen the enforcement of laws, strictly pursue cross-border liability, clarify the main body of responsibility, and improve the compensation mechanism, so as to ensure that the responsibility can be effectively and efficiently carried out; and improve the emergency preparedness and liability implementation mechanism, and build an efficient and sensitive mechanism for the implementation of emergency preparedness. implementation mechanism, build an efficient and sensitive monitoring system, formulate scientific and reasonable coping strategies, and strengthen the construction of contingency plans and response systems, so as to ensure that transboundary water resources pollution problems can be properly and effectively managed, and ultimately realize the sustainable use of water resources and the goal of international environmental justice.

Acknowledgment

All contributions of the third parties can be acknowledged in this section.

Conflict of Interest

The authors declare no conflict of interest.

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