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EDITED BY

Yen-Chiang Chang,
Dalian Maritime University, China

REVIEWED BY

Chuanliang Wang,
Shandong Normal University, China
Yuanhong Shi,
China University of Political Science and
Law, China

*CORRESPONDENCE

Jing Gao
✉ 002347@sdupl.edu.cn

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Global ocean governance after WOA III: bridging the science–policy gap amid institutional fragmentation

Chengyong Yu and Jing Gao*

Shandong University of Political Science and Law, Jinan, China

The Third World Ocean Assessment (WOA III), released by the United Nations in June 2026, is the largest and most comprehensive global scientific assessment of the ocean to date. The Assessment has revealed, with a high degree of scientific certainty, the severe conditions facing the global ocean, while simultaneously revealing a persistent structural deficiency: the existing governance architecture remains significantly fragmented across sectors and regions. Adopting institutional fragmentation as an analytical lens, this article examines the limitations of the current governance architecture—comprising the United Nations Convention on the Law of the Sea (UNCLOS), the BBNJ Agreement, and Regional Fisheries Management Organizations (RFMOs)—from three dimensions: structural, normative, and procedural. The study finds that the translation of scientific assessment into policy action faces three major obstacles: temporal mismatches between scientific cycles and political decision-making, the weak constraining force of international soft law, and the strategic use of scientific knowledge in political bargaining. The core argument of this article is that institutional fragmentation, rather than the insufficiency of scientific knowledge per se, constitutes the fundamental structural barrier to improving the effectiveness of global ocean governance. The article proposes four pathways: aligning scientific and institutional decision-making, strengthening the normative uptake of scientific assessments, improving the use of scientific knowledge, and fostering cross-sectoral institutional coordination. These findings contribute to the theoretical debate on the science-policy interface in global environmental governance and offer practical implications for the reform of global ocean governance architecture in the post-WOA III era.

KEYWORDS

BBNJ agreement, global ocean governance, institutional fragmentation, Third World Ocean Assessment, UNCLOS

1 Introduction

June 8, 2026, marked the 18th World Oceans Day, on which the United Nations officially released the Third World Ocean Assessment (WOA III). This represents the most comprehensive scientific assessment to date for global ocean governance under the framework of the Regular Process for Global Reporting and Assessment of the State of the Marine Environment, including Socioeconomic Aspects. WOA III not only covers natural science dimensions, including ocean physics, chemistry, biology, and ecology, but

also systematically incorporates perspectives from economics, sociology, law, and policy science for the first time, providing an in-depth institutional analysis of the global ocean governance architecture itself.

In his message marking the release of the report, United Nations Secretary-General António Guterres described WOA III as an authoritative record of the deepening crisis driven by climate change, overfishing, biodiversity loss, and marine pollution. He also called on the international community to “establish a new relationship with the ocean: one based on science, framed by international law (Chen and Zhang, 2022), and founded on shared responsibility among countries, sectors, and generations” (United Nations, 2026e). This statement accurately captures the central challenge facing contemporary global ocean governance: the existence of an institutional gap between the accuracy of scientific assessments and the effectiveness of policy responses, which remains far from being adequately bridged (Borja et al., 2016).

In fact, WOA III itself recognizes this issue. On the one hand, the report identifies several positive developments in the field of global ocean governance in recent years, including the 57 global ocean conservation treaties, among which the BBNJ Agreement entered into force on January 17, 2026. On the other hand, it acknowledges that global ocean governance remains “significantly fragmented” across sectors and geographical regions (Lausen and Buerkert, 2025), and that insufficient institutional coordination constitutes a key bottleneck in enhancing governance effectiveness. In other words, the picture presented by WOA III is twofold: the deterioration of marine ecosystems is clearer than ever before, while the institutional capacity to address this deterioration has failed to develop at the same pace (United Nations, 2026d).

This picture raises a fundamental theoretical and practical question: Does the accumulation of scientific certainty necessarily lead to enhanced governance effectiveness? More specifically, can the unprecedented volume of scientific evidence provided by WOA III be translated into tangible global ocean governance outcomes, and if so, under what conditions? (Matovu et al., 2024) The answer to this question concerns not only the proper positioning of WOA III but also the underlying logic of institutional design for global ocean governance.

The central argument of this article is that the release of WOA III marks a new stage in global ocean governance, in which the tension between scientific certainty and institutional fragmentation has become more pronounced than ever before. Scientific assessments have brought unprecedented clarity to the nature and urgency of marine challenges (Franke et al., 2023); however, institutional fragmentation prevents such enhanced understanding from being translated into coordinated and effective action. The causal pathway between scientific certainty and governance effectiveness is profoundly mediated by institutional structures.

To systematically substantiate this central argument, this paper introduces “institutional fragmentation” as its core analytical framework. This concept has been extensively developed in the fields of international relations and international law. In the field of international law, fragmentation refers to the lack of coherence and coordination among international legal rules and institutions, resulting in a fragmented and unsystematic legal order. In the field of global governance, governance architecture is defined as the

overall system of effective or active public and private institutions, principles, norms, regulations, decision-making procedures, and organizations within a particular issue area of world politics, and scholars have conducted systematic analyses of the fragmentation of such governance architectures (Kirton and Trebilcock, 2017).

Drawing on the aforementioned theoretical resources, this paper analyzes institutional fragmentation from three dimensions: structural fragmentation (the coexistence of overlapping institutional jurisdictions and institutional gaps), normative fragmentation (the potential conflicts or inconsistencies among norms generated by different institutions), and procedural fragmentation (the lack of coordination among the decision-making procedures, participation rules, and accountability mechanisms of different institutions). This three-dimensional framework runs throughout the paper and is applied respectively to examine the governance implications of the scientific findings of WOA III, identify the structural limitations of the existing global ocean governance architecture, diagnose the institutional roots of barriers in the transmission from science to policy (Fawkes and Cummins, 2019), and explore possible pathways for institutional responses on this basis.

2 Analytical framework and literature review

2.1 Research review

The issue of institutional fragmentation in global ocean governance has drawn widespread attention from scholars both domestically and internationally (United Nations, 2026c). Research by domestic scholars started relatively late. Currently, no literature specifically on WOA III has been found; the related studies focus on global ocean governance. Liu Xiaowei (2022) published “Fragmentation in the global ocean governance Framework: Concepts, Representations, and Impacts,” pointing out that the current global ocean governance framework shows fragmented characteristics, manifested in the existence of various types of global ocean governance institutions and organizations, diverse institutional systems, and mechanisms with different regional authorizations. It is not dominated by a single international system, showing a ‘patchwork’ feature. The article argues that governance fragmentation is a neutral concept, simultaneously representing both the achievements of continuous development in global ocean governance and the institutional roots of its difficulties. Jiang Xiaoyi and Gao Tianyi (2022) published “Fragmentation of International Regulation on Marine Biodiversity Conservation: Real Causes, Legal Dilemmas, and Solutions,” noting that current international regulations on marine biodiversity conservation show obvious fragmentation. This is mainly reflected in the lack of uniformity and connectivity in relevant international legal documents, the diverse and independently operating conservation subjects, and the disconnected conservation targets. The study further points out that the fragmentation of international regulations leads to disputes over the scope of framework conventions, considerable subjectivity in interpreting and applying certain rules and principles, hindering the

achievement of overall marine environmental goals and dispute resolution, and may also affect the new progress in international lawmaking on BBNJ.

Foreign academia has explored the theory of fragmented global ocean governance more deeply. [Biermann and others \(2009\)](#) published “The fragmentation of global governance architectures: A framework for analysis,” proposing a theoretical framework for analyzing the fragmentation of global governance structures. [Biermann and Kim \(2020\)](#), in “Architectures of Earth System Governance,” further discussed the characteristics of fragmentation, polycentrism, and complexity in global governance. Regarding the relationship between the BBNJ Agreement and institutional fragmentation, [Lausen and Buerkert \(2025\)](#) published “Fragmentation Revisited: A Critical Analysis of the Effects of Introducing the BBNJ Agreement into the global ocean governance Landscape” in the *Nordic Journal of International Law*. They define “fragmentation” as a concept related to institutions, norms, and actors, and argue that the fragmentation brought by the BBNJ Agreement “is not necessarily a problem ([Kopela, 2026](#)).” The agreement might enhance governance effectiveness by promoting either synergistic or cooperative fragmentation. However, some scholars take a cautious view, noting that the BBNJ Agreement enters a legal and conceptual landscape characterized by fragmentation and biodiversity definition disputes. On the science–policy interface, [Tessnow-von Wysocki and Vadrot \(2024\)](#) published “Pathways of scientific input into intergovernmental negotiations: a new agreement on marine biodiversity” in *International Environmental Agreements*. Their research found that scientific input in BBNJ negotiations is neither systematic nor transparent; it depends on available national scientific capacity, financial resources, pre-established communication channels, and active participation of actors, calling for a formalized science–policy interface. The above studies provide the theoretical foundation and scholarly dialogue space for this paper’s analysis of institutional fragmentation.

2.2 Analytical framework

As an analytical concept, “institutional fragmentation” can be traced back to the intersection of multiple theoretical traditions in international relations research. Within the institutionalist tradition, the issue of fragmentation originates from observations regarding the increasing “density” of international institutions. As global governance issues have expanded and deepened, the number, types, and scope of international institutions have continued to increase, while coordination among these institutions has not improved correspondingly. Within the constructivist tradition, fragmentation concerns the potential logical conflicts and value tensions among institutional norms. In the field of global administrative law, fragmentation involves differences and mismatches among various institutions with respect to procedural justice and accountability mechanisms.

This paper adopts [Young’s \(2002\)](#) classic definition of institutional fragmentation: within a particular governance domain, two or more institutional arrangements exist that are functionally interconnected and involve overlapping or intersecting jurisdictions yet lack a clear hierarchical relationship or effective coordination

mechanisms among themselves ([Young, 2002](#)). The core features of institutional fragmentation can be understood from the following four dimensions. First, institutional proliferation refers to the continuous increase in the number of institutions within a governance domain, with each institution possessing its own independent legal foundation, membership composition, and organizational structure. Second, jurisdictional overlap refers to the intersection of the mandates of different institutions, whereby the same issue may simultaneously fall within the jurisdiction of multiple institutions or may not fall within the jurisdiction of any institution. Third, normative inconsistency refers to potential conflicts or tensions among norms generated by different institutions, in the absence of meta-rules for coordinating the relationships among these norms. Fourth, the absence of coordination mechanisms means that, even where institutional interaction is required, effective cross-institutional coordination procedures are lacking, and conflicts or overlaps among institutions can only be resolved through case-by-case and non-institutionalized approaches.

The theoretical value of institutional fragmentation lies in its expansion of the analytical focus from the design and performance evaluation of individual institutions to the analysis of interactions among multiple institutions. Fragmentation represents neither complete disorder nor an organically integrated system; rather, it exists in the form of an “institutional complex” ([Gehring and Faude, 2014](#)). An institutional complex refers to “an overall configuration composed of multiple institutional arrangements with different legal statuses and distinct functional mandates within a particular issue area,” whose defining characteristic is precisely the absence of a unified hierarchical structure capable of integrating the relationships among different institutions.

Analytical Dimensions of Institutional Fragmentation: Structural, Normative, and Procedural Dimensions. To transform institutional fragmentation from an abstract concept into an operational analytical tool, this paper introduces three specific analytical dimensions.

Structural fragmentation focuses on the patterns of spatial and functional coverage of institutions ([Kreuder-Sonnen and Zürn, 2020](#)). From a spatial perspective, structural fragmentation manifests itself in the concentration of institutions in certain regions and the existence of institutional gaps in others; from a functional perspective, it is reflected in institutional overlaps in certain issue areas and governance deficits in others. The analytical tasks of structural fragmentation include identifying gaps in institutional coverage, identifying areas of overlapping jurisdictions, and assessing the overall adequacy of institutional arrangements.

Normative fragmentation focuses on the logical relationships among the norms generated by different institutions. The relationships among norms can be broadly classified into three categories: consistency, complementarity, and conflict. The analytical tasks of normative fragmentation include identifying potential points of conflict among institutional norms, analyzing the sources of such conflicts and their possible consequences, and assessing whether inter-institutional coordination mechanisms are sufficient to prevent the escalation of normative conflicts.

Procedural fragmentation focuses on differences in the decision-making processes and participation rules of different institutions. Different institutions may have different membership

compositions (global versus regional), different decision-making rules (consensus-based decision-making versus majority voting), different transparency requirements, and different levels of participation by non-state actors. The analytical tasks of procedural fragmentation include identifying how differences in decision-making rhythms affect the capacity for coordination among institutions and identifying how asymmetries in participation rules affect the fairness and legitimacy of governance.

These three analytical dimensions are not independent of one another; rather, they are interconnected. Structural overlaps in jurisdiction often give rise to potential normative conflicts, while normative conflicts become difficult to resolve through negotiation due to procedural differences (Ahmed, 2025). In the subsequent analysis, these three dimensions will provide a systematic analytical framework for examining the institutional complex of global ocean governance (See Figure 1 for details).

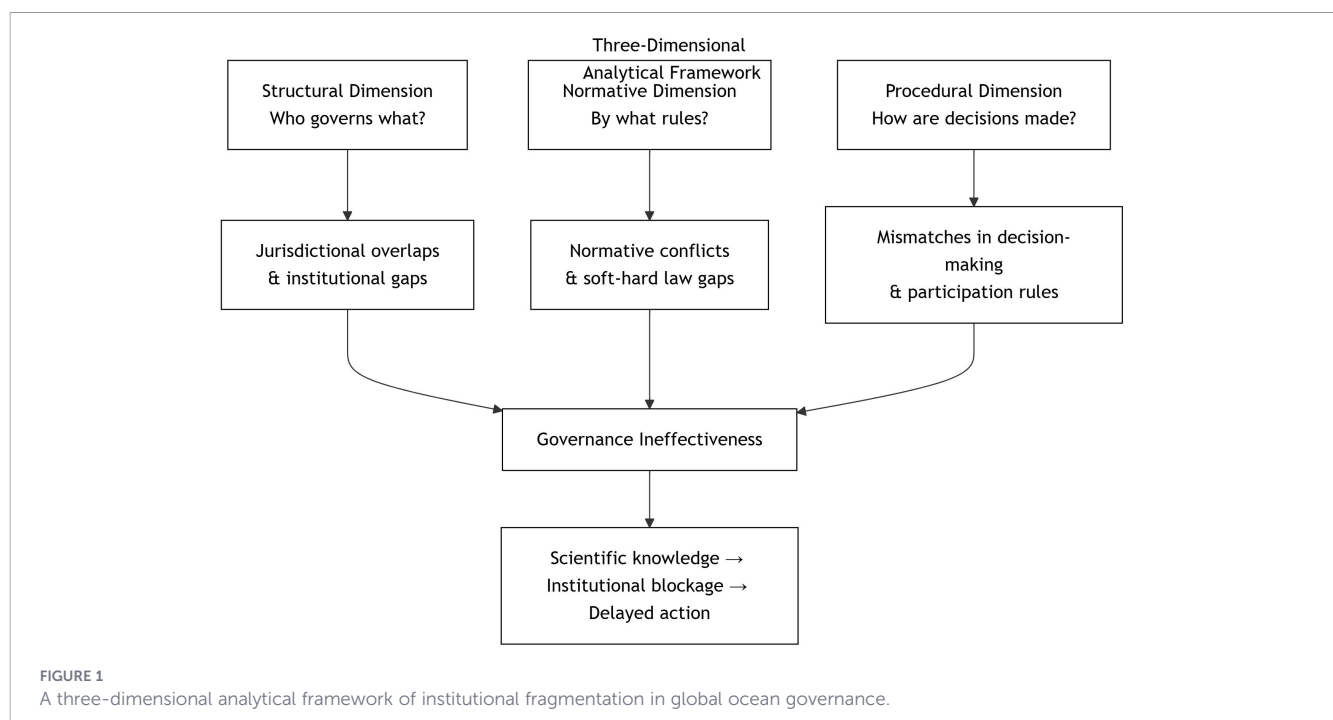
Applying the aforementioned theoretical framework to the field of global ocean governance reveals a typical “institutional complex” structure within global ocean governance (Lin and Tsai, 2026). The institutional complex of global ocean governance can be described at three levels.

The first level consists of the global comprehensive legal framework, with the United Nations Convention on the Law of the Sea (UNCLOS) as its core. UNCLOS provides the foundational legal framework for global ocean governance by establishing the legal status of different maritime zones and the framework of rights and obligations for coastal States, flag States, and port States. However, UNCLOS primarily constitutes an institutional arrangement concerning the “allocation of jurisdiction” rather than a substantive regulatory system for “resource management” and “ecological protection” (Hansen et al., 2013). Its institutional design prioritizes the delineation of States’ jurisdictional boundaries, while treating ecosystem integrity as a secondary consideration.

The second level consists of sector-specific global institutional arrangements, including the BBNJ Agreement (the conservation of marine biodiversity beyond national jurisdiction), the United Nations Fish Stocks Agreement (UNFSA) (the conservation and management of straddling fish stocks and highly migratory fish stocks) (Hamlington et al., 2024), MARPOL (the prevention of pollution from ships), the London Convention (the regulation of ocean dumping), and other shipping regulatory regimes established under the framework of the International Maritime Organization (IMO) (United Nations, 2026f). Addressing specific issue areas and particular marine utilization activities, these institutions each possess relatively independent decision-making mechanisms, normative frameworks, and membership compositions.

The third level consists of regional governance mechanisms, with Regional Fisheries Management Organizations (RFMOs) as the core component, while also encompassing regional marine conventions (such as the Barcelona Convention and the Nairobi Convention), regional fisheries arrangements, and marine ecosystem initiatives. The advantage of regional mechanisms lies in their ability to better reflect specific geographical and socio-economic contexts; however, their disadvantages include incomplete coverage, uneven institutional quality, and unclear mechanisms for coordination with global governance frameworks.

The relationship among these three levels is far from an idealized model of division of responsibilities and cooperation (Ehlers, 2024). From a structural perspective, global frameworks often have overly broad mandates and lack operational implementation mechanisms; sectoral regimes exhibit both overlapping jurisdictional scopes (such as the intersection between fisheries management and biodiversity conservation) and regulatory gaps (such as cross-sectoral assessments of cumulative impacts); regional mechanisms suffer from incomplete geographical coverage, with some marine areas subject to multiple regional regimes while others



lack any regional institutional arrangements. From a normative perspective, potential tensions exist among the principles and values underlying different regimes. Conflicts among free trade and resource conservation, sovereign rights and common concerns, and scientific decision-making and political negotiations lack clear coordination rules in practice. From a procedural perspective, the decision-making processes of different regimes are highly asynchronous, eligibility for participation varies significantly, and accountability mechanisms operate under separate systems, creating substantial operational obstacles to cross-regime coordination.

Institutional fragmentation is typically manifested in global ocean governance in that no single regime possesses a comprehensive mandate to coordinate and manage all human activities within a particular marine area; nor does any regime have clearly defined authority to reconcile the relationships among different sectoral regimes. The absence of a central coordinating authority results in the overall effectiveness of global ocean governance being significantly lower than the aggregate effectiveness of individual sectoral governance regimes.

In the context of institutional fragmentation, scientific assessments, such as WOA III, perform a distinctive institutional function while also facing unique functional limitations. From a functional perspective, global scientific assessments such as WOA III make at least three indispensable contributions to fragmented institutional complexes. First, they perform a knowledge integration function. WOA III systematically integrates scientific information dispersed across different disciplines, regions, and institutions, thereby creating a shared knowledge base that can be jointly referenced by different regimes. Such knowledge integration helps reduce the transaction costs arising from information fragmentation. Second, they perform an agenda-setting function. By revealing the severity and urgency of governance gaps, WOA III has the potential to place specific issues on the agendas of different regimes and encourage institutional systems to respond to existing deficiencies. Third, they perform a normative guidance function. While providing scientific data, WOA III also embodies judgments regarding what constitutes effective governance. Such judgments can serve as reference points in the normative coordination among different regimes.

However, the realization of the functions of scientific assessments in the context of fragmentation faces structural constraints. First, scientific assessments themselves do not generate institutional integration effects. Within the independent decision-making procedures of different regimes, the findings of WOA III may be interpreted, filtered, or even selectively ignored by different actors in different ways. Second, the production process of scientific assessments is itself influenced by the fragmented governance structure. Regional disparities in data reflect uneven institutional coverage, while the geographical distribution of participating experts reflects the unequal distribution of scientific capacity. Third, the translation of scientific assessments into policy is contingent upon the respective procedural arrangements of different regimes, with no unified and effective pathway for such translation (Evans et al., 2019).

Understanding the governance implications of WOA III cannot be limited to summarizing its scientific findings; rather, it must be situated within the structural context of institutional fragmentation.

WOA III is both a “diagnostic tool” of institutional fragmentation, as it reveals the governance consequences of fragmentation, and a “product” of institutional fragmentation, as its processes of production, dissemination, and utilization are profoundly shaped by the fragmented governance structure.

2.3 Materials

To ensure a systematic analysis of the global ocean governance landscape after WOA III and the issue of institutional fragmentation, this study is based on a comprehensive collection and review of primary and secondary sources. The selection of research materials follows two principles: first, authoritative documents under the United Nations framework are used as the core primary sources; second, cutting-edge research in international academic journals on institutional fragmentation, global ocean governance, and the BBNJ Agreement serves as the theoretical foundation (Morgera et al., 2023).

Primary sources. At the level of international legal instruments, this study identifies and examines the following core treaty texts: (1) the United Nations Convention on the Law of the Sea (UNCLOS), which serves as the foundational legal framework for global ocean governance; (2) the Agreement on the Conservation and Sustainable Use of Marine Biological Diversity of Areas Beyond National Jurisdiction (BBNJ Agreement), which entered into force on January 17, 2026, and represents the latest institutional development for the conservation of biodiversity in areas beyond national jurisdiction; (3) the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement, which provide the international legal basis for addressing climate change-related marine issues, including sea-level rise; and (4) the Convention on Biological Diversity (CBD) and its Kunming-Montreal Global Biodiversity Framework, including the “30×30 target.” All of the above treaty texts were obtained through the United Nations Treaty Collection.

At the level of official United Nations documents, this study systematically collected relevant documents concerning WOA III, including: (1) the full report of WOA III and its executive summary, obtained from the official website of the United Nations Regular Process for Global Reporting and Assessment of the State of the Marine Environment; (2) the interactive data provided by the WOA III digital platform; (3) statements by the United Nations Secretary-General concerning WOA III and World Oceans Day; and (4) the official press release issued by the United Nations Sustainable Development Group on WOA III (June 8, 2026). In addition, this study also referred to United Nations General Assembly Resolution 79/144 on the initiation of the fourth cycle of the Regular Process.

At the level of regional governance mechanisms, this study reviewed relevant documents of Regional Fisheries Management Organizations (RFMOs), including their conservation and management measures, decision-making procedures, and scientific assessment reports. The information was obtained from the Food and Agriculture Organization of the United Nations (FAO) report *The State of World Fisheries and Aquaculture* and the official websites of individual RFMOs.

Secondary sources. At the level of the theoretical framework, this study adopts institutional fragmentation theory as the primary

analytical tool and draws extensively on [Biermann et al.'s \(2009\)](#) seminal article, “The Fragmentation of Global Governance Architectures: A Framework for Analysis,” published in *Global Environmental Politics*, as well as Young's (2010) monograph, *Institutional Dynamics: Emergent Patterns in International Environmental Governance*, published by MIT Press. These works provide the theoretical foundation for constructing a three-dimensional analytical framework encompassing the structural, normative, and procedural dimensions.

At the level of research on the BBNJ Agreement, this study systematically searched and reviewed academic articles published since 2020 in journals including *Marine Policy*, *Ocean & Coastal Management*, *Frontiers in Marine Science*, *Ocean Development & International Law*, *Nordic Journal of International Law*, and *Biodiversity and Conservation*. These studies cover topics such as the impact of the BBNJ Agreement on the global ocean governance architecture, institutional fragmentation, marine protected areas in areas beyond national jurisdiction, environmental impact assessments, capacity-building, and technology transfer.

At the level of science-policy interface research, this study reviewed relevant literature published in journals such as *Sustainability Science* and *Ocean & Coastal Management*, covering topics including the linkage between the WOA and global policy processes, as well as knowledge exchange at the interface between marine science and policy.

The above-mentioned academic literature was obtained through keyword searches conducted in the Web of Science Core Collection, Scopus, and other academic databases. The search terms included “WOA,” “WOA III,” “BBNJ Agreement,” “institutional fragmentation,” “global ocean governance,” “high seas,” “marine protected areas,” “science-policy interface,” “UNCLOS,” and “RFMOs.” The search period covered from 2010 to 2026.

Selection Criteria for Research Materials. The selection of research materials in this study follows the following criteria: (1) authority: priority is given to official United Nations documents, international treaty texts, and peer-reviewed journal articles; (2) timeliness: priority is given to literature published between 2020 and 2026, while incorporating classical theoretical works; (3) relevance: the materials must be directly related to global ocean governance, institutional fragmentation, the BBNJ Agreement, or the science-policy interface; and (4) accessibility: all materials are obtained through publicly available channels to ensure verifiability.

2.4 Methods

The present study combines doctrinal legal analysis with comparative institutional analysis to systematically examine the issue of institutional fragmentation within the global ocean governance framework following the release of WOA III. The overall methodological logic is as follows: first, it conducts a doctrinal analysis of the primary and secondary materials identified above; on this basis, it employs institutional comparison to reveal the

structural, normative, and procedural relationships among different governance mechanisms.

First, this study conducts a doctrinal analysis of the collected legal texts and institutional documents. Methodologically, it does not treat international treaties, United Nations resolutions, regional governance arrangements, and soft law instruments as isolated normative systems; rather, it interprets them as interactive components within a unified yet fragmented institutional complex. Although this study distinguishes, in its analysis, between the binding effects of hard law instruments (such as UNCLOS and the BBNJ Agreement) and the voluntary nature of soft law instruments (such as the assessment conclusions of WOA III and United Nations General Assembly resolutions), its analytical focus lies in the functional interactions among them. Drawing on the perspective of transnational environmental law, this study examines the factual effectiveness of soft law norms in governance practices ([Etty et al., 2022](#)). Instead of viewing soft law as an inferior substitute for hard law, it understands soft law as an indispensable institutional element within a fragmented governance structure. The purpose of this analysis is not only to clarify the normative implications of individual legal provisions but also to reveal the interactions among these norms, thereby identifying the mutual embeddedness, overlap, and potential conflicts of norms within the institutional complex of global ocean governance.

Based on the foregoing doctrinal analysis, this study further applies the functional comparative method to examine how different governance mechanisms address common governance challenges within their respective institutional contexts. The core premise of the functional comparative method is that different legal systems can respond to the same social problem through different institutional means and are therefore comparable. The common functional question identified in this study is: within a fragmented institutional landscape lacking a unified authority, how do different governance mechanisms respond to the scientific certainty revealed by WOA III and enhance governance effectiveness? This common question provides a unified analytical reference point for cross-institutional comparison, ensuring the logical consistency of comparisons among different institutional frameworks.

The criteria for selecting institutions follow the principle of diversity and encompass the following three dimensions:

First, diversity of institutional types. The governance mechanisms selected in this study represent three distinct institutional models within global ocean governance. UNCLOS represents a comprehensive global legal framework, with the allocation of jurisdictional authority as its core function ([Pedrozo, 2022](#)). The BBNJ Agreement represents sector-specific global institutional innovation, focusing on the specialized issue of biodiversity conservation in areas beyond national jurisdiction. Regional Fisheries Management Organizations (RFMOs) represent regional governance mechanisms characterized by sectoral resource management. Together, these three mechanisms embody three institutional types: the “constitutional framework,” the “sector-specific institution,”

and the “regional arrangement,” thereby providing a comprehensive picture of the institutional complex of global ocean governance.

Second, diversity of governance levels. The governance mechanisms examined in this study span two governance levels: global and regional. At the global level, the analysis covers UNCLOS, the BBNJ Agreement, and relevant United Nations documents; at the regional level, it includes Regional Fisheries Management Organizations (RFMOs) and regional seas conventions. This cross-level institutional coverage enables the analysis to reveal the vertical interactions among institutions operating at different levels, namely, how global institutions are implemented at the regional level and how regional institutions respond to global institutions.

Third, diversity of functional orientations. The institutions selected in this study differ in their governance functions. UNCLOS focuses on the allocation of jurisdiction and the construction of a legal framework (Tzeng, 2016); the BBNJ Agreement emphasizes institutional innovation in biodiversity conservation (De Lucia, 2025); and Regional Fisheries Management Organizations (RFMOs) focus on the sustainable management of fisheries resources. This functional diversity enables the comparative analysis to reveal horizontal interactions across different functional areas, namely, how fisheries management intersects with biodiversity conservation and how resource utilization creates tensions with environmental protection.

The comparability among the aforementioned institutions does not stem from similarities in their institutional structures, but rather from the functional challenges they jointly confront, namely, achieving effective governance within a fragmented landscape and applying a unified analytical framework for institutional fragmentation. If the selected institutions were structurally homogeneous, the purpose of functional comparison would not be achievable.

The boundaries of the methodological design of this study should be clarified. This study adopts a doctrinal analysis supplemented by comparative institutional research to examine the formal frameworks of legal documents, policy texts, and institutional designs, as well as their functional operation. The materials relied upon include treaty texts, official United Nations documents, academic literature, and institutional reports. This study does not incorporate primary empirical data, such as interviews, field observations, or quantitative data. Therefore, the findings regarding governance effectiveness should be understood as normative assessments of institutional design rather than empirical verifications of the effects of institutional implementation. This limitation will be further discussed in the conclusion section.

3 WOA III's scientific findings and governance diagnosis

WOA III covers an extremely broad range of topics, from physical changes in the ocean to biodiversity status, from pollution distribution to socio-economic impacts, and from governance structures to future scenarios. This section focuses on three

categories of findings with direct governance implications and, in each category of analysis, draws on the theoretical framework established above to reveal their institutional significance.

3.1 Accelerating changes in the ocean physical environment and the governance dilemmas of structural fragmentation

The most striking finding of WOA III regarding the ocean physical environment concerns sea-level rise. The rate of global mean sea-level rise has increased from approximately 2 millimeters per year before 2015 to 4.3 millimeters per year in 2023, more than doubling within a decade (United Nations, 2026b) (BBNJ Agreement 2026). This acceleration highlights the growing urgency of sea-level-related governance challenges, indicating that non-linear processes such as ice-sheet melting are advancing at a faster-than-expected pace. According to the estimates of WOA III, if the current emission pathways continue, global sea-level rise could reach 1 to 2 meters by the end of this century, directly threatening approximately 11% of the global population living in areas less than 10 meters above sea level (United Nations Environment Programme, 2022).

The increase in ocean heat content is equally alarming. According to WOA III, approximately 16% of the total increase in global ocean heat content since 1955 occurred after 2018; in other words, in less than seven years, the ocean absorbed more than one-sixth of the heat accumulated over the previous six decades (Institute of Atmospheric Physics, Chinese Academy of Sciences, 2025). The greatest relative warming occurred in the Atlantic Ocean as well as in the southern regions of the Indian and Pacific Oceans. Due to the irreversible nature of the thermal expansion of seawater, this accumulated heat will continue to affect sea levels and circulation patterns for centuries to come.

From the perspective of institutional fragmentation, accelerating changes in the ocean physical environment pose at least three structural challenges to the fragmented governance complex (Hamlington et al., 2024). First, the destabilization of jurisdictional stability. Species migration causes fish stocks to cross existing management boundaries, triggering jurisdictional disputes among different institutions; sea-level rise may alter the position of baselines and affect the determination of coastal States' jurisdictional scope. Existing institutional arrangements have extremely limited capacity to address such “dynamic jurisdiction” issues (Bache et al., 2016), because the amendment mechanisms of UNCLOS are highly rigid, while other institutions lack the mandates necessary to address cross-boundary jurisdictional issues. Second, mismatches in temporal dynamics. The decision-making pace of governance institutions is far slower than the rate of physical change, while differences in decision-making timelines among institutions make coordinated actions capable of rapid response almost impossible. Third, fragmentation of adaptation actions. Coastal adaptation involves multiple sectors, including coastal zone management, infrastructure planning, disaster prevention and control, and ecosystem management. These areas fall under the jurisdiction of different institutions and lack an integrated institutional framework.

3.2 Ecosystem degradation and the governance gaps of normative fragmentation

The assessment results of WOA III regarding marine ecosystems are alarming. WOA III estimates that approximately 52.1 million tons of plastic waste enter the ocean every year, generating about 24.4 trillion microplastic particles. These particles have affected more than 4,000 marine species. Meanwhile, ocean acidification, driven by the absorption of atmospheric CO₂ by the ocean, is progressing at the fastest rate in the past 2,600 years (Xinhua News Agency, 2026). The cumulative effects of acidification are particularly pronounced in polar regions and upwelling areas, profoundly affecting the survival conditions of calcifying organisms such as shellfish and pteropods.

In terms of biodiversity, the trend is equally concerning. Climate change is systematically altering the geographic distributions of species, with many fish and invertebrate species migrating toward the poles at rates of several tens of kilometers per decade (Miller, 2020). The data from WOA III indicate that the number of critically endangered marine species has increased fivefold compared with the WOA II period, while the number of endangered species has doubled. Coral reef ecosystems are facing an “unprecedented crisis,” and global coral cover is projected to decline further by 70% to 90% by the 2040s.

From the perspective of normative fragmentation, ecosystem degradation reveals the deeper problem of normative incoherence within the institutional complex of global ocean governance. First, tensions among sectoral norms. Trade liberalization norms encourage fisheries subsidies, whereas resource conservation norms call for their reduction. The prolonged deadlock in WTO fisheries subsidies negotiations (Hopewell, 2026) represents a typical example of the lack of coordination among different normative domains. Second, normative gaps in the implementation of principles. “Ecosystem-based management” (EBM) is recognized across different institutions, but the specific normative standards adopted by each institution vary considerably. RFMOs primarily understand EBM as the conservation of target species, whereas the BBNJ Agreement interprets EBM as the protection of ecosystem integrity. These divergent normative understandings make cross-institutional coordination lack a common frame of reference. Third, the gap between institutional commitments and actual normative implementation. The disparity between the general obligation to “protect and preserve the marine environment” established under Article 192 of UNCLOS, the “30×30 target” under the framework of the Convention on Biological Diversity, and the high seas conservation commitments under the BBNJ Agreement, on the one hand, and the actual trends revealed by WOA III, on the other, continues to widen (Ministry of Ecology and Environment, 2022). This gap constitutes the most direct indicator for assessing governance effectiveness.

3.3 Information constraints arising from uneven knowledge production and procedural fragmentation

An often overlooked yet profoundly significant finding of WOA III concerns the structural unevenness inherent in knowledge production itself. As of 2025, only 27.3% of the seafloor areas

have achieved modern-standard mapping accuracy (Cunningham et al., 2026). This means that the topographic and habitat information of the deep ocean, which accounts for more than 70% of the Earth’s surface area, remains at a stage of rough estimation. It is estimated that approximately 90% of marine species have yet to be scientifically described. Moreover, even for known species and regions, the temporal and spatial coverage of long-term monitoring data remains highly uneven: data density in the North Atlantic and North Pacific is far higher than that in the Southern Hemisphere and the Indian Ocean, while monitoring in coastal waters is substantially more comprehensive than that in the open ocean.

From the perspective of procedural fragmentation, uneven knowledge production generates at least three governance constraints. First, there are structural disparities in participatory capacity. Experts from developing countries remain comparatively underrepresented in global ocean knowledge production, contributing to geographical imbalances in the knowledge base. Such biases, in turn, affect the voice and agenda-setting capacity of developing countries within various regimes. Countries with weaker knowledge production capabilities are often placed in a disadvantaged position in institutional negotiations. Second, there are procedural barriers to data sharing. The monitoring systems established under different regimes operate independently, with significant differences in data formats, standards, and accessibility, making cross-regime data integration highly challenging. The information exchange mechanism (Clearing-House Mechanism) established under the BBNJ Agreement seeks to address this issue, but its effectiveness depends on whether States Parties are willing to participate substantively, which ultimately returns to the question of political will. Third, there are differences in assessment cycles. Different regimes require different assessment schedules (annual assessments by RFMOs, periodic assessments under the BBNJ Agreement, and five-year assessments under WOA), and the lack of coordination among these assessment timelines makes information synchronization across regimes difficult to achieve.

It is worth noting that WOA III itself is both a product and a reflection of such procedural fragmentation. The geographical imbalance, unequal participation, and issue-selection biases embedded in its knowledge production process are not only consequences of the fragmented governance structure but also reinforce the existing configuration of structural power by shaping the production of “authoritative knowledge” (See Table 1 for details).

The institutional roots and operational mechanisms of the three transmission barriers identified in this section will be systematically examined in Chapter 5.

4 Fragmented governance architecture: a structural, normative, and procedural examination

4.1 UNCLOS as a framework institution: structural limitations and normative lag

UNCLOS is the undisputed legal cornerstone of global ocean governance (Tzeng, 2016). Since its adoption in 1982 and entry into

TABLE 1 Key indicators of WOA III: changes from WOA II to WOA III (United Nations, 2026a).

Indicator	WOA II baseline	WOA III latest data	Trend of changes
Rate of sea level rise	~2 millimeters per year (prior to 2015)	4.3 mm per year (2023)	An increase of more than 100% ↑
Increase in ocean heat content since 1955	All	16% of the total increase occurred after 2018.	Marked acceleration ↑
Annual plastic waste entering the ocean	8 to 12 million tons	52.1 million tons	A significant increase ↑
Microplastic particles	~15 trillion	24.4 trillion	Continuously increasing ↑
Seabed mapping coverage	~20%	27.3%	Gradual improvement →
Critically endangered marine species	Benchmark	5 times since the release of WOA II	Dramatic deterioration ↑

↑, upward trend; ↓, downward trend; →, broadly stable or slow change.

force in 1994, UNCLOS has established the fundamental rules governing the delimitation of maritime zones, provided legal regimes for various types of marine utilization activities, and established institutions such as the ISA, CLCS, and ITLOS. With 168 States Parties, UNCLOS has become one of the most widely accepted multilateral treaties worldwide (Barnes, 2016).

However, when UNCLOS's structural limitations are examined through the three dimensions of institutional fragmentation, its lack of adaptability becomes clearly evident (Pedrozo, 2022).

From a structural perspective, UNCLOS's institutional design is centered on the allocation of jurisdictional authority, dividing ocean space into different jurisdictional zones, rather than being oriented toward ecosystem-based management. This design logic is effective in addressing traditional maritime disputes but is insufficient for addressing ecological processes that do not conform to jurisdictional boundaries, such as fish stock migration, pollution dispersion, and carbon cycling. More importantly, the amendment mechanism of UNCLOS is highly complex and rigid: any amendment must be adopted by a two-thirds majority of the States Parties, and an amendment can enter into force only after being ratified by three-fourths of the States Parties. In practice, this threshold is almost insurmountable. The rigidity of the amendment mechanism means that UNCLOS has great difficulty adapting to emerging governance needs through formal amendment procedures. This also explains why the third implementing agreement of UNCLOS—the BBNJ Agreement—was adopted in the form of an “agreement” rather than an “amendment,” as the former provides greater political feasibility for adoption.

From a normative perspective, the environmental protection provisions of UNCLOS exhibit a pronounced framework-oriented character, lacking specific implementation standards and enforcement mechanisms (Vaangal, 2022). Article 192 establishes the general obligation to “protect and preserve the marine environment,” while Article 194 requires States to take measures to

“prevent, reduce, and control pollution of the marine environment (Everaert et al., 2018).” However, the normative density of these provisions is insufficient to address contemporary complex environmental challenges. Issues such as ocean acidification, plastic pollution, and species migration caused by climate change extend far beyond the scope anticipated during the drafting of UNCLOS. The gap between the normative framework established by UNCLOS and the demands of contemporary global ocean governance has continued to widen.

More importantly, UNCLOS lacks a systematic scientific advisory mechanism. Although UNCLOS has established several scientific subsidiary bodies (such as the CLCS), their functions are limited to specific technical issues rather than serving as a comprehensive science–policy interface.

4.2 The BBNJ agreement: the promise of institutional innovation and the continuation of fragmentation

The BBNJ Agreement, after nearly two decades of negotiations (2004–2023), was adopted on June 19, 2023, reached the threshold for entry into force in September 2025, and officially entered into force on January 17, 2026 (Overview of the BBNJ Agreement 2026). The number of Parties to the Agreement has continued to increase since its entry into force. The core content of the Agreement covers four key issues: (1) marine genetic resources and benefit-sharing; (2) area-based management tools (including marine protected areas); (3) environmental impact assessments; and (4) capacity-building and technology transfer. Its objective is to “ensure the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction” (Jacquemont et al., 2024), applying to marine biodiversity in areas beyond national jurisdiction (BBNJ Agreement 2026).

From the perspective of institutional innovation, the BBNJ Agreement fills the institutional gap under the UNCLOS framework regarding the absence of dedicated arrangements for the protection of marine biodiversity in areas beyond national jurisdiction, representing a significant institutional shift from “fragmented sectoral management” to a “comprehensive ecosystem-based approach.” However, when examined through the three dimensions of institutional fragmentation, the institutional design of the BBNJ Agreement itself remains embedded with the logic of fragmentation (Kim, 2024).

From the structural dimension, the relationship between the BBNJ Agreement and existing institutions represents the most fundamental structural issue. The “not to undermine” principle established in Articles 5(2) and 22(2) of the Agreement requires that the implementation of the Agreement must not undermine the authority and responsibilities of existing legal instruments and frameworks. This principle reflects a compromise designed to preserve the mandates of existing institutions. However, it may also create difficulties in coordinating overlapping institutional mandates. When marine protected areas established under the BBNJ Agreement overlap with fishing grounds managed by RFMOs, how should the “not to undermine” principle be operationalized? This issue lacks a clear answer at the level of

institutional design (Zhou, 2026). Moreover, the structural relationship between the BBNJ Agreement and other sectoral regimes, such as the IMO (regulation of international shipping) and the ISA (deep-sea mining), has likewise not been clearly addressed.

From the normative dimension, although the BBNJ Agreement establishes an institutional framework for the protection of marine biodiversity in areas beyond national jurisdiction, its normative content still contains substantial ambiguities. How should “fair and equitable benefit-sharing” be defined and operationalized in practice? How should the criterion of “significant adverse impacts” in environmental impact assessments be determined (Wang and Li, 2025)? What are the criteria for selecting area-based management tools? These normative gaps need to be filled through subsequent decisions by the COP, and the process of filling these gaps will inevitably involve political bargaining among the parties.

From the procedural dimension, the first meeting of the Conference of the Parties (COP) to the BBNJ Agreement is expected to be convened in late 2026 or early 2027. Prior to this meeting, many procedural arrangements under the Agreement, including the specific operational rules of the STB, the operational procedures for the information exchange mechanism, and the governance structure of the capacity-building fund, have yet to be determined. The ultimate governance effectiveness of the BBNJ Agreement will largely depend on these subsequent procedural developments (Blasiak and Jouffray, 2024).

4.3 RFMOs and sectoral governance: coverage gaps and procedural divergence

Regional Fisheries Management Organizations (RFMOs) are the primary institutional mechanisms for the governance of high seas fisheries. Globally, approximately 17 RFMOs are responsible for managing high seas fishing activities in different geographical regions and for different fish species. RFMOs are legally authorized to adopt conservation and management measures that are binding on their member States, including catch quotas, seasonal fishing closures, fishing gear restrictions, and boarding and inspection procedures. From a positive perspective, RFMOs have played an indispensable role in preventing the “tragedy of the commons” in high seas fisheries (Grafton et al., 2023).

However, when examined through the framework of institutional fragmentation, RFMOs also exhibit significant structural, normative, and procedural limitations (See Table 2 for details).

From a structural perspective, RFMOs have significant gaps in both geographical and species coverage. Certain areas of the high seas (such as parts of the Southern Ocean) lack dedicated RFMO arrangements, while the transboundary management of certain species (such as highly migratory sharks) remains extremely challenging (Cullis-Suzuki and Pauly, 2010). Meanwhile, the lack of coordination mechanisms between the regional delineations of RFMOs and the area-based management approaches established under the BBNJ Agreement may result in structural overlaps or gaps in jurisdiction (Leroy and Morin, 2018).

From a normative perspective, the sectoral nature of RFMOs, which focus primarily on fisheries while neglecting other sectors and ecosystem components, makes them ill-equipped to address cross-

sectoral and integrated governance challenges. Fisheries management decisions often consider only the status of target stocks, while giving insufficient attention to bycatch species, habitat impacts, and food web effects. Although “ecosystem-based fisheries management” (EBFM) has gained broad conceptual recognition, its implementation within RFMO practices has progressed slowly, reflecting the tension between sector-specific norms and ecosystem-based norms (Pentz et al., 2018).

From a procedural perspective, the decision-making mechanisms of RFMOs are often based on the principle of consensus. Consensus-based procedures can make collective action difficult when members hold conflicting interests. In relation to zero-sum issues such as the allocation of catch quotas, decision-making may result in relatively weak conservation measures (Singh et al., 2018). Moreover, RFMOs have limited binding authority over non-contracting parties. Although RFMO measures are theoretically binding on their members, their ability to regulate non-members relies on indirect means such as port State measures and trade restrictions, the effectiveness of which varies considerably. The differences in decision-making procedures between RFMOs and the BBNJ Agreement create operational obstacles to the coordination of the two institutional systems (Tian and Guo, 2025).

5 Three transmission barriers at the science–policy interface

The conclusions of scientific assessments do not automatically translate into effective governance action. A persistent structural disconnection exists between scientific evidence and institutional responses, with contributors to WOA III noting that the gap between scientific knowledge and practical application remains significant (Vlahos et al., 2026). This disconnection is a concrete manifestation of institutional fragmentation at the science–policy gap interface. Within a fragmented institutional complex, the pathway from scientific discovery to governance action must traverse multiple independent decision-making procedures simultaneously, each with its own rhythm, rules, and logic. This chapter systematically examines the structural obstacles in this transmission process along three dimensions: temporal mismatches, the constraining dilemmas of soft law norms, and the strategic use of scientific knowledge. These three barriers are interrelated and mutually reinforcing, together constituting critical bottlenecks in the chain from scientific findings to substantive governance improvements.

5.1 Temporal mismatch between scientific cycles and political decision-making

Scientific assessment and political decision-making operate on different timescales. The WOA III assessment cycle spans approximately five years, yet political decisions often require responses within months or even weeks. When an urgent ocean issue emerged in 2023, WOA III had not yet been released; by the time the report confirmed the issue in 2026, the institutional window for action

TABLE 2 Alignment between WOA III findings and existing governance mechanisms: an institutional fragmentation analysis.

WOA III findings	Relevant governance mechanisms	Structural coverage	Normative alignment	Procedural coordination
Sea-level rise	(UNFCCC 2006) UNFCCC/Paris Agreement	Indirectly related	Framework provisions	Significant divergence in timelines
Ocean acidification	Articles 194 and 207 of UNCLOS	No dedicated institutional arrangements	Principle-based obligations	No implementation procedures
Biodiversity in Areas Beyond National Jurisdiction (ABNJ)	BBNJ Agreement (entered into force in 2026)	Established	Implementation phase	COP1 pending convening
High seas fisheries	RFMOs + UNFSA	Incomplete coverage	Sector-specific orientation	Rigid decision-making mechanisms
Plastic pollution	MARPOL + Regional Conventions	Partial coverage	Sectoral fragmentation	Lack of coordination mechanisms
Cumulative impacts	No single governance mechanism	Institutional vacuum	Normative gaps	Complete absence

may have already closed. This temporal mismatch is further amplified within the context of institutional fragmentation.

The decision-making rhythms across governance mechanisms vary considerably. RFMOs typically hold annual meetings, the BBNJ Conference of the Parties is scheduled to meet biennially, and the UNCLOS Assembly of States Parties convenes triennially. The scientific findings of WOA III must be fed simultaneously into these decision-making procedures, each operating at a different rhythm, making cross-institutional coordination nearly impossible to achieve in the short term. The fragmented landscape of global ocean governance means that the conclusions of scientific assessments must enter multiple independent institutional channels, each with its own agenda-setting mechanisms and prioritization logics (Chang et al., 2020).

The consequences of this temporal mismatch are multiple. First, the timeliness of scientific assessments is undermined: by the time WOA III finally confirms a given issue, the relevant institutional window may have already closed. Second, scientific advice may be diluted or reinterpreted as it enters different decision-making procedures; the same scientific conclusion may be assigned different weights and meanings in different institutional contexts. Third, decision-makers lack institutional channels for taking coordinated action promptly after scientific evidence emerges; within the fragmented institutional complex, there is no single science-policy interface, but rather multiple independent interfaces lacking effective coordination mechanisms among them (Lausen and Buerkert, 2025).

Notably, contributors to WOA III have already recognized this problem. Some scholars have observed that the three ocean assessments constitute a trajectory that enables us to see more clearly where we have been and where we are going, yet the rhythm of this trajectory does not align with the rhythm of institutional decision-making. WOA III specifically recommends in the report exploring the establishment of more flexible thematic assessment mechanisms to respond to emerging urgent issues. However, whether this recommendation itself can be adopted and implemented by the various governance mechanisms still depends on institutional coordination capacity within the fragmented landscape. The broad mandate of WOA III, the multi-scalar nature of ocean information production, and the gaps and uncertainties in the linkage between knowledge and institutions all pose challenges to the translation of science into institutions (See Table 3 for details).

5.2 The limited normative force of scientific assessments

WOA III is a scientific assessment report, not a legal instrument. Its positioning as “policy-relevant but not policy-prescriptive” means that none of its recommendations are legally binding on states. Its non-binding nature constitutes a second barrier to the translation of scientific knowledge into institutional action.

The normative dilemma of soft law can be understood at two levels. The first is the compliance incentives level: since WOA III’s

TABLE 3 Gap analysis between the recommendations of WOA III and the existing governance architecture (categorized by dimensions of fragmentation).

WOA III emphasized directions	Structural gaps	Normative gaps	Procedural gaps
Cumulative impact assessment	Institutional vacuum	Absence of standards	Complete absence
Ecosystem approach	Sectoral fragmentation	Paradigmatic divergence	Lack of coordination mechanisms
Science-based decision-making	Incomplete scientific advisory bodies	Uncertain weighting of scientific evidence	Disconnect between assessment and decision-making
Capacity-building for developing countries	Unequal distribution of capacities	Insufficient implementation of the principle of equity	Asymmetrical participation rules
Regular monitoring and assessment	Coverage gaps	Lack of unified standards	Inconsistent temporal cycles
Cross-sectoral coordination	Structural disconnects	Unresolved normative conflicts	Lack of procedural linkages

recommendations are not legally binding, states face no legal consequences for non-compliance (Mendenhall and Hassanali, 2023). For states with a strong willingness to act, WOA III can provide scientific guidance, but for actors lacking governance willingness, WOA III cannot exert additional constraint. The second is the institutional embedding level: even if states are willing to be guided by WOA III, translating scientific recommendations into binding institutional arrangements still requires passage through the respective decision-making procedures of each governance mechanism, where scientific advice may be diluted, delayed, or entirely shelved.

WOA III is not an isolated case. In the field of global ocean governance, soft law norms commonly face similar constraint dilemmas. Some studies have pointed out that although international soft law lacks legally binding force, it embodies mainstream values and influences the formation of hard law. Soft law can serve as a precursor to hard law and enhance its normativity by being implicitly incorporated into hard law. However, this transformation process does not occur automatically; it requires specific institutional conditions and political will. In the fragmented landscape of global ocean governance, the channels for transforming soft law into hard law are neither unified nor smooth. WOA III's scientific recommendations must enter the decision-making procedures of multiple institutions, including RFMOs, BBNJ, and IMO, each of which has different understandings and requirements for how scientific evidence should be translated into institutions. One direct consequence of the fragmentation of global ocean governance is that the governance of the high seas water column has long been fragmented, sectoral, and largely reactive.

The Scientific and Technical Body (STB) established under Article 49 of the BBNJ Agreement faces a similar dilemma. The STB can provide scientific and technical advice to the Conference of the Parties but transforming that advice into binding decisions still requires political negotiation (Ricard, 2024). Some scholars, after analyzing the scientific advisory bodies of twelve intergovernmental organizations, found that the vast majority of scientific advice receives respect from the Conference of the Parties because the deliberative process is based on science, balance, inclusivity, and transparency (Langlet and Vadrot, 2023). However, whether scientific advice is ultimately adopted still depends on the political will of the parties. Scientific evidence has already fully revealed the severe situation facing the ocean, but whether WOA III's recommendations can be transformed into binding institutional arrangements depends on the coordinated operation of multiple decision-making procedures within a fragmented landscape, a condition that is not easily satisfied under the current institutional architecture.

5.3 The strategic use of scientific knowledge

The third barrier to the translation of science into institutions concerns the way scientific knowledge itself is utilized in political processes. Within a fragmented institutional context, the findings of WOA III may be interpreted, filtered, or even selectively disregarded by different actors. Various state coalitions, industry groups, and non-governmental organizations may selectively cite specific

findings from the report to support their pre-established institutional positions (Krabbe and Wagenaar, 2026).

The discussions on benefit-sharing of marine genetic resources during the BBNJ negotiations provide a telling example. Developed countries emphasized freedom of research and intellectual property protection, while developing countries stressed fair and equitable benefit-sharing, with both sides citing different scientific evidence and economic analyses to justify their respective positions. One study systematically examined the multiple pathways through which scientific input entered the BBNJ negotiations and found that such input was neither systematic nor transparent, but rather depended on available national scientific capacity, financial resources, established channels of communication, and the active engagement of actors (Búason and Jónsson, 2025). This means that scientific knowledge undergoes multiple layers of filtering before entering the institutional process. Which scientific evidence is produced, by whom, through what means it enters negotiations, and by whom it is invoked—each of these stages is shaped by power structures and the distribution of resources.

The strategic use of knowledge does not negate the value of scientific assessment. Even in contexts of strategic utilization, scientific evidence still constitutes the “hard currency” of argumentation; actors generally seek to present their institutional positions as consistent with scientific evidence. However, it does undermine the linear expectation that “more science automatically leads to better institutions.” The composition of WOA III's expert body is dominated by developed countries, and the geographic coverage of data is highly uneven, which may itself affect the acceptance of the assessment's conclusions among different actors. In a fragmented institutional context, scientific knowledge serves both as a shared informational foundation and as a resource in political bargaining. This reality calls for a shift in our understanding of the science-policy gap relationship from a linear model to a more complex interactive one (Mulalap et al., 2020). The BBNJ Agreement provides new opportunities to advance the science-policy gap-society interface in global ocean governance processes. Institutional Pathways for global ocean governance in the Post-WOA III Era Institutional Pathways for global ocean governance in the Post-WOA III Era, but whether these opportunities are seized depends on whether states are willing to move beyond strategic utilization and truly base their decisions on science (Kim, 2024).

6 Institutional pathways for global ocean governance in the post-WOA III era

The science-policy gap revealed by WOA III is not unbridgeable. The three barriers identified above provide the basis for four specific institutional pathways. The adoption and entry into force of the BBNJ Agreement provide a new institutional platform for bridging this gap, offering a new legal framework for the protection of marine ecosystems increasingly threatened by economic activities (Krabbe and Wagenaar, 2026). Building on the foregoing analysis, this chapter proposes four specific institutional pathways: the

institutionalized alignment of scientific and political decision-making rhythms, the enhancement of the normative constraining force of international soft law, the institutional prevention of the strategic use of scientific knowledge, and the construction of cross-sectoral institutional coordination mechanisms. These pathways are not independent of one another; rather, they are interrelated and mutually reinforcing, together constituting a systematic framework for institutional improvement in global ocean governance in the post-WOA III era.

6.1 Institutionalized alignment of scientific and institutional decision-making rhythms

The key to bridging the temporal mismatch lies in establishing more flexible and timely science–policy gap bridging mechanisms. WOA III has already pointed in this direction, recommending the exploration of more frequent thematic assessment mechanisms to respond to emerging urgent issues. The core logic of this recommendation is to expand scientific assessments from a single five-year cycle into a multi-layered temporal framework, preserving the five-year comprehensive assessments to provide systematic knowledge while adding rapid assessment mechanisms for specific issues to respond to urgent institutional needs.

The BBNJ Agreement's STB can serve as an important vehicle for this mechanism. The STB's responsibilities include providing scientific and technical advice to the Conference of the Parties, and its working modalities can be defined by the first meeting of the COP. Some studies have pointed out that the STB's meeting frequency and working modalities need to ensure its ability to fulfill time-bound tasks. This means that the STB must not only regularly assess existing scientific evidence but also possess the capacity to respond rapidly to emerging scientific information. The STB could also establish informal *ad hoc* technical expert groups to address scientific issues requiring urgent attention between formal meetings. Canada's formal submissions to the BBNJ Preparatory Commission also supported granting the STB the capacity to establish *ad hoc* technical expert groups to advance its core functions under relevant provisions of the Agreement (Wang and Xue, 2026).

Furthermore, coordination of decision-making rhythms across institutions is equally crucial. There is a lack of effective rhythm coordination mechanisms among RFMOs' annual meetings, the BBNJ COP's biennial meetings, and the UNCLOS Assembly of States Parties' triennial meetings. Consideration could be given to establishing a dedicated science–policy gap coordination agenda item within the BBNJ COP's agenda, inviting representatives from the scientific advisory bodies of relevant institutional mechanisms such as RFMOs, IMO, and ISA to participate in discussions, coordinating on shared scientific issues and decision-making timelines (Clark, 2020). While such coordination cannot eliminate the rhythmic differences among institutions, it can at least reduce the risk of scientific advice falling through the cracks due to rhythm mismatches.

6.2 Pathways for enhancing the normative influence of non-binding scientific assessments

The non-binding nature of WOA III limits its direct institutional influence. International legal theory and practice demonstrate that soft law can acquire normative effects similar to hard law through various pathways. Some studies have pointed out that by invoking soft law rules in international treaties, soft law can be endowed with effects akin to binding rules. In certain cases, soft law rules become hardened through repeated or analogous incorporation into binding instruments. Soft law can serve as a precursor and foundation for hard law, and hard law rules do not eliminate soft law.

This insight offers possible pathways for enhancing the normative constraining force of WOA III. First, the core recommendations of WOA III could be confirmed and refined through resolutions of the BBNJ COP, thereby acquiring procedural effect under the framework of the BBNJ Agreement. The BBNJ Agreement's STB can provide scientific advice to the COP, and the COP can in turn transform such advice into normative documents of guiding significance through resolutions (Lyu et al., 2026). Second, the assessment framework and methodology of WOA III could serve as a common reference for scientific assessments undertaken by various governance mechanisms. When RFMOs, IMO, ISA, and other institutions conduct their own scientific assessments, they could refer to the standards and methods of WOA III, thereby rendering the scientific assessments of different institutions more comparable and interoperable. Third, the conclusions of WOA III could serve as a scientific baseline for decision-making across institutions. When all institutions base their decisions on the same set of scientific facts, even in the absence of direct coordination mechanisms, the risk of normative conflicts among institutions can be reduced.

The BBNJ Agreement's STB holds unique potential for enhancing the constraining force of soft law. An effective STB must not only produce high-quality scientific advice but also embody essential qualities such as inclusiveness, fairness, transparency, flexibility, and synergy with existing governance frameworks. The effectiveness of the STB will critically depend on its ability to identify, understand, and respond in a timely manner to new information concerning impacts on marine biodiversity. The relatively general provisions concerning the STB's mandate and working procedures may give rise to uncertainty in implementation. Therefore, the first meeting of the COP needs to clarify the legal effect of STB advice, its weight in decision-making procedures, and the procedural obligations of parties to respond to scientific advice. Of course, the hardening of soft law cannot be achieved overnight. It requires sustained institutional effort and political will. However, as the only comprehensive global ocean assessment covering environmental, economic, and social dimensions under the United Nations framework, WOA III's authority and comprehensiveness provide a unique foundation for this transformation.

6.3 Institutional prevention of the strategic use of scientific knowledge

The strategic use of scientific knowledge is rooted in imbalances in power structures and resource distribution. While it cannot be entirely eliminated, it can be mitigated through institutional design. The experience of the BBNJ negotiations demonstrates that the quality and influence of scientific input depend on national scientific capacity, financial resources, established channels of communication, and the active engagement of actors. Therefore, enhancing the fair and transparent use of scientific knowledge in institutional processes requires action on multiple fronts.

First, the participation of developing countries in scientific assessments should be expanded. The composition of WOA III's expert body is dominated by developed countries, which to some extent affects the acceptance and legitimacy of the assessment's conclusions. The fourth cycle of the Regular Process has already identified capacity-building as one of its core tasks, providing an institutional platform for expanding the participation of experts from developing countries. Greater involvement of developing country scientists in the drafting and review of WOA IV would not only enrich the knowledge base of the assessment but also enhance the credibility of its conclusions among developing countries.

Second, mechanisms for scientific information transparency and independent review should be established. The greater the transparency of information, the less room there is for strategic invocation. The BBNJ Agreement's Clearing-House Mechanism can serve as a technical platform for sharing scientific information across institutions. Through this platform, WOA III's scientific data, management experiences, and best practices can flow more smoothly among institutions, reducing strategic interpretation driven by information asymmetry. Some scholars have recommended the establishment of a formalized science-policy gap interface, initiated by the United Nations Secretariat, to ensure that the global knowledge base serves decision-making.

Third, the application of scientific advice in decision-making procedures should be standardized. The STB's terms of reference and working modalities need to clarify the status and role of scientific advice in the decision-making process. Research by Hitziger and Speer suggests that while the STB's decision-making procedures should strive for consensus, voting procedures can make scientific advice clearer, more concise, and more timely, as voting can incentivize parties to make compromises in the consensus-building process. Robust safeguards against conflicts of interest should be established, with members serving in their personal capacity and terms of office long enough to enable them to fully integrate into their roles and mentor younger colleagues. Although these institutional designs cannot entirely eliminate the strategic use of knowledge, they can raise the costs of such use, thereby discouraging it to some extent. The Canadian government has also recommended that when STB members are unable to reach consensus, both majority and minority opinions should be

presented to the COP to overcome situations where consensus cannot be achieved.

6.4 Building cross-sectoral institutional coordination mechanisms

The most concentrated manifestation of governance fragmentation revealed by WOA III is the lack of effective coordination mechanisms among sectoral institutions. Climate change, biodiversity, fisheries resources, and other areas remain fragmented, making it difficult to address the compound challenges facing ocean systems (Búason and Jónsson, 2025). Some scholars have pointed out that the BBNJ Agreement not only perpetuates the conceptual fiction that marine biodiversity can be governed independently of geology, but also exacerbates this fragmentation through the molecular reduction of life itself. Therefore, cross-sectoral institutional coordination constitutes a comprehensive pathway for bridging the science-policy gap.

One feasible direction is to utilize the BBNJ COP as a platform for cross-sectoral coordination. The BBNJ Agreement covers four major issues, including marine genetic resources, area-based management tools, environmental impact assessments, and capacity-building and transfer of marine technology, involving multiple sectors such as fisheries, shipping, and deep-sea mining. The COP could invite representatives from relevant institutional mechanisms, including RFMOs, IMO, and ISA, to participate in its meetings to consult on cross-sectoral issues such as area-based management tools and environmental impact assessments. However, the institutional nature of the BBNJ Agreement is highly decentralized, and there is a risk of exacerbating fragmentation in high seas conservation efforts (Tessnow-von Wysocki and Vadrot, 2022). Some studies have suggested that the increased fragmentation brought by the BBNJ Agreement is "not necessarily a problem" and that the Agreement may enhance governance effectiveness by promoting synergistic or cooperative fragmentation. However, in the absence of widespread ratification, the risk of introducing conflicting norms into the global ocean governance landscape remains high (Lausen and Buerkert, 2025).

The second direction is to develop cross-sectoral scientific assessment mechanisms. WOA III has given greater attention to the governance dimensions of ocean sustainability, providing a shared governance diagnosis for all institutions. Subsequent WOA assessments could further strengthen this function by assessing the coordination status and institutional gaps among institutions while providing scientific evidence, thereby laying a scientific foundation for cross-sectoral coordination.

The third direction is to explore informal normative coordination, establishing normative convergence among sectoral institutions through soft means such as joint guidelines, common principles, or best practice standards. The BBNJ Agreement's STB could develop non-binding technical guidelines to promote coordinated strategic environmental assessment practices. Although such soft coordination lacks legally binding force, it can help

form shared normative expectations among sectoral institutions. The fragmented landscape of global ocean governance cannot be changed overnight, but through gradual institutional coordination, institutionalized spaces for cooperation can be cultivated within fragmentation.

7 Conclusion

WOA III has revealed, with a high degree of scientific certainty, the severe conditions facing the global ocean. Yet its deeper contribution lies in giving greater attention to governance architecture within the assessment framework, highlighting a persistent structural challenge in global ocean governance: institutional fragmentation. Employing an analytical framework of institutional fragmentation, this article has demonstrated the roots of the science–policy gap from three dimensions. Structural fragmentation manifests in the coexistence of overlapping jurisdictions and institutional gaps. Normative fragmentation is reflected in tensions and conflicts among different institutional norms. Procedural fragmentation is expressed in variations across institutions in decision-making rhythms and participation rules. The three transmission barriers—temporal mismatches, the constraining dilemmas of soft law, and the strategic use of knowledge—are further amplified within a fragmented context, together constituting critical bottlenecks in the chain from scientific discovery to governance improvement. Bridging this gap requires coordinated progress along four complementary pathways: institutional design under the BBNJ Agreement, optimization of the Regular Process mechanism, and cross-sectoral coordination. Ultimately, science has made these challenges clearer than ever before, but translating scientific certainty into effective governance ultimately depends on whether states possess the political will and institutional capacity to move beyond fragmentation.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material. Further inquiries can be directed to the corresponding author.

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