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Approaches to legal governance in constructing Nanhai National Marine Park

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As a globally significant marine ecosystem, the South China Sea faces multiple challenges including overfishing, ecological degradation, and geopolitical conflicts. To balance ecological conservation with resource development needs, establishing a South China Sea National Marine Park has emerged as a critical strategy. This paper employs literature analysis, comparative research, and policy evaluation methods to investigate legal governance frameworks for the marine park. The study reveals that China's current marine conservation legal framework faces challenges such as fragmented legislation, weak enforcement mechanisms, and inadequate integration between international and domestic laws, which hinder cross-border ecological cooperation. To address these issues, the paper proposes enhancing specialized domestic legislation, optimizing enforcement and supervision systems, and promoting regional marine conservation agreements to establish a legal framework tailored to the South China Sea's unique characteristics. The research also demonstrates that legal development for the marine park must reconcile ecological integrity with geopolitical realities, fostering regional cooperation and trust through legal innovation. This study offers a feasible legal pathway for ecological governance in disputed waters while laying the foundation for sustainable blue economy development.

KEYWORDS

National Marine Park, Nanhai (South China Sea), ocean governance, joint protection, marine environmental protection, regional cooperation, China

1 Introduction

As a typical semi-enclosed marine ecosystem, the South China Sea demonstrates ecological vulnerability and sensitivity. From an ecological perspective, this region exhibits unique biodiversity characteristics, serving as both a habitat for diverse marine species and a vital ecological corridor. In recent years, however, intensified human activities have placed unprecedented pressure on the region's ecosystems, presenting significant challenges to its environmental sustainability.

From a biodiversity perspective, the South China Sea ecosystem exhibits distinct regional variations. Key ecosystems such as coral reefs, mangroves, and seagrass beds

form the backbone of its biodiversity. These ecosystems not only provide habitats for numerous marine species but also play a crucial role in maintaining oceanic ecological balance. However, studies indicate that the health of these ecosystems is deteriorating continuously, with biodiversity indices showing declining trends in some regions (Semon et al., 2025). This change will not only affect the stability of the ecosystem but also may trigger a chain reaction that threatens the ecological security of the entire South China Sea.

In terms of water quality, the South China Sea faces threats from multiple pollution sources. Land-based pollutants enter the ocean through riverine discharge and atmospheric deposition, causing deterioration of water quality in coastal areas. Notably, eutrophication caused by excessive nutrient inputs has become particularly severe, altering water physicochemical properties and potentially triggering harmful algal blooms (HABs) and other ecological disasters (Peng et al., 2024). At the same time, the spread of new pollutants such as microplastics continues to expand, posing a potential threat to marine life. In addition, the impact of sulfur dioxide emissions from ports and the pollutants generated during shipping operations should not be underestimated (Wang et al., 2025). These pollutants are transferred and enriched through the food chain, which may ultimately affect the health of the entire ecosystem (Jia et al., 2022).

Human activities exert diverse disturbances on the ecological environment of the South China Sea. Overfishing has led to the decline of fishery resources, with sharp reductions in the populations of certain economically important fish species, thereby disrupting the integrity of the marine food web (Fu, 2025). Offshore sand mining directly damages the benthic habitat and affects the living environment of benthic organisms. Reclamation projects in coastal areas have changed the natural coastline morphology and weaken the ecological function of coastal zones (Wei et al., 2023). These human interference factors compound each other, exacerbating the rate of ecosystem degradation.

The impact of climate change is also not to be ignored. Rising seawater temperatures have led to frequent coral bleaching, threatening the survival of coral reef ecosystems (Wang X. et al., 2023). Ocean acidification changes the chemical environment of seawater and affects the growth and development of calcium-based organisms. The increased frequency and intensity of extreme climate events, such as typhoons and storm surges, have further exacerbated ecosystem vulnerability (Liu et al., 2023). These climate change factors intertwine with human activity impacts, forming compound ecological pressures.

Geopolitical factors have added special complexity to the ecological protection of the South China Sea. Disputes over maritime jurisdiction have made it difficult to effectively implement conservation measures in contested areas, creating a management vacuum (Salleh et al., 2021). Transboundary ecological issues such as pollution dispersion and competition for fishery resources lack effective coordination mechanisms. This situation makes the ecological environment of the South China Sea face the risk of "tragedy of the commons", that is, all coastal states ignore the overall ecological protection in order to pursue their own interests (Mao et al., 2023).

From the perspective of governance system, the ecological protection of the South China Sea is faced with institutional obstacles. The existing protection measures are fragmented and lack systematization and coordination (Wu et al., 2024). The monitoring networks suffer from inadequate coverage, hindering timely tracking of ecological changes. The law enforcement capacities remain limited, which makes it difficult to effectively curb illegal activities. These institutional deficiencies have compromised conservation effectiveness, making it difficult to fundamentally reverse ecological degradation trends (Quan, 2022).

To address these challenges, it is imperative to reassess strategies and approaches for South China Sea ecological conservation. Traditional protection models have proven inadequate to tackle the current complexities, necessitating the establishment of a more systematic and coordinated conservation framework. This requires not only considering the natural attributes of ecosystems but also addressing regional development needs and practical conditions for international cooperation (Duan and Wang, 2023). Only through scientific understanding and implementation of comprehensive protection measures can we effectively safeguard the health and stability of the South China Sea's ecosystem (Huang et al., 2024). Compared with existing research, the innovation of this study lies in its promotion of regional cooperation and trust-building through legal innovation, while taking into account both the ecological integrity of the South China Sea and geopolitical realities. This approach offers a new perspective on legal pathways for protecting the marine ecological environment of the South China Sea.

2 International marine conservation trends and experience

In recent years, international marine conservation has shown a trend of shifting from single species protection to holistic ecosystem protection. This shift is reflected in conservation philosophies that prioritize marine protected area (MPA) networks to safeguard ecosystem integrity (Duan and Wang, 2023). The European Union serves as a typical example of this approach. Through a regional cooperation network, the EU has established a transnational marine conservation system, achieving coordinated regional governance. Meanwhile, the United Kingdom has leveraged its global marine conservation network, emphasizing scientific research and international collaboration. Regarding management approaches, the international community generally adopts a tiered and classified management frameworks, designating multi-functional zones such as core conservation areas, ecological restoration zones, and sustainable use zones based on regional ecological sensitivity and resource endowment characteristics (Li et al., 2024). The United States has extensive practice in this regard, having established a multi-tiered marine conservation system and relying on advanced technological means for monitoring and management. Countries such as Australia and Japan have adopted similar integrated management models, seeking a balance between conservation and utilization. This zoning management

mode not only guarantees the authenticity of the ecosystem but also balances the needs of sustainable utilization of resources.

In terms of management measures, international experience shows that effective marine conservation requires a trinity of scientific monitoring, strict law enforcement and community participation (Xu et al., 2025). The scientific monitoring system employs remote sensing, buoys, and manual patrols to achieve real-time ecological monitoring in protected areas. Robust enforcement regimes leverage satellite remote sensing and drone technology to enhance detection and response capabilities for illegal activities. Community engagement mechanisms utilize benefit-sharing and ecological compensation to mobilize local participation (Li et al., 2023). This comprehensive approach has proven effective in enhancing conservation outcomes.

International marine conservation is also showing a trend from passive protection to active restoration. Ecological restoration technologies, such as coral reef restoration and seagrass bed reconstruction, have demonstrated efficacy across multiple marine regions (Lan et al., 2023). These technologies not only restore degraded ecosystems but also enhance their resilience to climate change and anthropogenic disturbances. Concurrently, the ecosystem-based adaptive management concept has gained widespread adoption, enabling dynamic adjustments of conservation strategies in response to environmental changes (Zheng et al., 2023).

In terms of institutional design, international experience underscores the critical role of legal frameworks. Many countries have enacted dedicated legislation to clarify the legal status, administrative authority, and enforcement procedures of protected areas (Wu et al., 2024). At the same time, an interdepartmental coordination mechanism have been established to integrate regulatory capacities across environmental protection, fisheries, maritime affairs, and other relevant agencies, forming synergistic management efforts (Mao et al., 2023). For transboundary conservation, regional cooperation frameworks such as joint monitoring and information sharing provide an effective way to deal with cross-border ecological issues (Chen and Fang, 2022).

These international experiences offer significant lessons for the development of national marine parks in the South China Sea. The zoning management model can balance conservation and utilization needs across different regions; an integrated governance system is well-suited to address regulatory challenges in the vast maritime areas; ecological restoration technologies help rehabilitate damaged ecosystems like coral reefs; while regional cooperation mechanisms provide practical references for managing complex cross-border conservation issues (Salleh et al., 2021). International practice shows that in maritime waters with sovereignty disputes, the establishment of marine parks and other forms of protection can not only achieve ecological protection goals, but also create conditions for regional cooperation (Ma, 2022). Therefore, leveraging international experience to establish national marine parks in the South China Sea indeed represents a feasible ecological conservation solution (Duan and Wang, 2023).

3 Legal framework requirements for establishing Nanhai National Marine Park

3.1 Deficiencies in the existing marine conservation legal framework

3.1.1 Limitations of domestic marine conservation laws

China's current marine conservation legal framework demonstrates limitations in addressing ecological protection needs in the South China Sea, primarily manifested in three dimensions: legislative framework, enforcement mechanisms, and cross-border coordination.

From the perspective of legislative framework, existing laws lack systematic consideration for holistic marine ecosystem protection, with fragmentation evident among various regulations. Specialized statutes such as the Marine Environmental Protection Law, Fisheries Law, and Island Protection Law operate in isolation, failing to form a cohesive legal network. This legislative fragmentation results in fragmented protection of marine ecosystems, directly undermining implementation effectiveness and leaving comprehensive conservation zones like marine parks without adequate legal support. In terms of legal content, current provisions are lagging behind in response to emerging marine environmental challenges. Issues such as ocean acidification, microplastic pollution, and coral bleaching lack targeted institutional designs in existing laws (Lan et al., 2023). The pace of legal updates has lagged far behind the accelerating pace of ecological degradation, creating regulatory vacuums for pressing environmental problems. Particularly noteworthy is the insufficient recognition of marine ecosystem service values in current legislation, with absence of market-based conservation mechanisms like ecological compensation and damage liability systems (Li et al., 2023). This deficiency hampers motivation for stakeholder participation in conservation efforts.

At the enforcement mechanism level, current legal deterrence effectiveness fails to match the severity of marine ecological challenges. Administrative penalties are generally too low, while criminal prosecution thresholds remain excessively high, undermining effective deterrence. Marine enforcement agencies commonly face practical difficulties in conducting routine patrols across the vast maritime areas of the South China Sea due to inadequate personnel capacity and outdated equipment. Enforcement processes are further hampered by overlapping jurisdictions and poor coordination among departments, with fragmented management by environmental protection, coast guard, and fisheries administration authorities leading to inefficient enforcement. This enforcement weakness directly erodes the practical binding force of legislation. Weaknesses in legal implementation safeguards are equally concerning. Imperfect technical support systems for marine environmental monitoring and ecological assessment compromise the scientific basis of

enforcement (Zhang et al., 2024). Inadequate public participation mechanisms and limited social oversight channels prevent the formation of conservation synergies (Chen, 2023). Impediments to judicial remedies, coupled with insufficient applicability of environmental public interest litigation in marine contexts, hinder timely ecological restoration for damaged areas. These deficiencies in support mechanisms prevent well-intentioned laws from achieving effective governance outcomes.

The absence of a cross-border law enforcement mechanism for illegal activities remains another critical weakness in current legal framework. Numerous transboundary ecological violations occur in the South China Sea, including illegal fishing and cross-border pollution, yet domestic legislation lacks effective regulatory provisions for such acts. On one hand, current laws fail to establish effective accountability mechanisms for foreign entities committing illegal activities within China's jurisdictional waters. On the other hand, there is insufficient extraterritorial jurisdiction to address violations committed by Chinese citizens in waters beyond Chinese jurisdiction (Quan, 2022). This legal vacuum enables cross-border ecological violations to evade punishment, significantly undermining ecological conservation effectiveness in the South China Sea. In terms of coordination mechanisms, there is a serious lack of cross-administrative legal coordination. Provincial-level jurisdictions along the South China Sea coast exhibit disparities in marine conservation standards and enforcement practices, leading to inconsistent protection outcomes (Zhu et al., 2022). The absence of a unified regional coordination mechanism has made it difficult to effectively address cross-provincial marine environmental issues. This administrative fragmentation sharply contradicts the holistic nature of marine ecosystems, substantially weakening conservation efficacy. Moreover, unclear delineation of marine protection responsibilities between central and local governments often leads to regulatory gaps or overlapping oversight, ultimately compromising the effectiveness of legal enforcement.

Overall, China's marine conservation legal framework faces multiple challenges in meeting the demands of establishing national marine parks in the South China Sea, including systemic deficiencies, weak enforcement capacity, and absence of coordination mechanisms. To effectively safeguard ecological security in the South China Sea, it is imperative to systematically address these legal deficiencies and construct a more scientific, rigorous, and efficient legal framework. When handling cross-border ecological issues, breakthroughs must be sought in aligning domestic laws with international regulations, thereby providing a solid legal foundation for regional marine protection cooperation (Chen and Fang, 2022).

3.1.2 Challenges in the interface between international and domestic law

The interface challenges between international and domestic law in marine conservation constitutes a pivotal element for establishing the legal framework governing the South China Sea National Marine Park. From a jurisprudential perspective, international law typically establishes global or regional protection standards through conventions and agreements, while domestic legislation focuses on institutional arrangements for practical implementation. These two systems inherently differ in legislative philosophy, normative content, and enforcement mechanisms, with such differences particularly pronounced in the unique context of the South China Sea. International law of the sea enshrines the principle of "the common heritage of mankind", emphasizing holistic protection of marine ecosystems, whereas domestic legislation tends to prioritize resource development and utilization rights within sovereign jurisdictions. This divergence in value orientations directly results in conflicts in legal application.

Inadequate coordination between coastal states and international actors has further exacerbated the challenges in legal alignment. In the South China Sea, marine management measures implemented by individual nations under domestic laws often diverge from the conservation standards advocated by the international community. Regarding fisheries resource management, the catch quota systems recommended by international organizations struggle to effectively align with the fishing permit mechanisms actually enforced by coastal states. In pollution control, emission standards stipulated in international conventions often exceed domestic regulatory requirements of most coastal states. These institutional gaps make it difficult to resolve cross-border marine environmental issues through a unified legal framework, potentially triggering new international disputes due to inconsistent enforcement standards.

Hierarchical disparities in legal efficacy constitute another critical constraint on harmonization effectiveness. As international law typically requires domestic legislative processes to gain direct binding force, countries around the South China Sea exhibit divergent approaches to domesticating international treaties. Some coastal states selectively apply international legal provisions to safeguard their so-called "maritime rights and interests", creating fragmented implementation that significantly undermines regional marine conservation efforts. When addressing cross-border environmental challenges like coral reef protection and marine debris management, fragmented domestic regulations alone cannot establish effective regulatory synergy.

The absence of procedural mechanisms similarly hinders the organic integration of legal systems. The South China Sea region currently lacks permanent legal coordination bodies, with neither a unified mechanism for establishing marine environmental standards nor standardized procedures for cross-border law enforcement cooperation. When marine environmental damage incidents occur, involved states often act unilaterally under domestic laws while neglecting procedural obligations such as notification and consultation required by international law. This procedural disconnect not only reduces the efficiency of legal implementation but may also escalate inter-state tensions through conflicting approaches to dispute resolution.

To achieve effective integration between international and domestic law, a multi-tiered institutional framework is essential. At the normative level, the "Framework Convention + Protocol" legislative approach can be adopted to preserve the principles of international rules while allowing flexibility for domestic legislation. At the institutional level, establishing regular consultation mechanisms will

facilitate coordination among national legislatures on technical issues during legal adaptation. Regarding implementation, operational arrangements such as joint law enforcement and information sharing should be explored to progressively unify disposal standards for transboundary environmental cases (Jia et al., 2022). It is particularly crucial to emphasize that such linkage should not be a one-way fit between domestic law and international law, but a virtuous cycle of two-way interaction – where international law should absorb beneficial practices from national legislative experiences, and domestic law should actively align with the trend of international conservation.

The harmonization of technical standards will serve as a crucial breakthrough for legal coordination. The construction of the South China Sea Marine Park involves numerous specialized technical specifications such as water quality monitoring and ecological assessments. If these standards fail to align with internationally recognized practices, it will directly result in regional disparities in conservation effectiveness. It is recommended to establish unified regional environmental benchmarks by referencing indicator systems from international instruments like the Convention on Biological Diversity, while allowing countries to set phased compliance requirements based on their actual conditions. This technical coordination model of "seeking common ground while reserving differences" not only maintains scientific rigor of legal norms but also accommodates implementation capabilities of nations with varying development levels.

3.2 Analysis of rule of law needs for Nanhai National Marine Park

3.2.1 Balancing ecological conservation and resource utilization

In the development of national marine park in the South China Sea, how to coordinate ecological conservation with rational resource utilization through rule of law instruments constitutes the core challenge for ensuring sustainable marine ecosystem development. Legal frameworks play a pivotal role here, not only providing clear legal foundations for environmental protection but also establishing boundaries and guidelines for rational resource management.

Rule of law instruments can establish ecological protection as a priority through legislation, ensuring the integrity and functionality of marine ecosystems. In developing the South China Sea National Marine Park, legal frameworks should delineate ecological conservation red lines through statutory provisions, explicitly prohibiting development in designated areas and restricting activities in buffer areas. Stringent environmental access control systems should be legislated to restrict or prohibit development activities potentially damaging to marine ecosystems. Additionally, laws should specify concrete measures such as ecological restoration and biodiversity conservation to maintain the stability and resilience of marine ecosystems (Xu et al., 2025).

Rule of law instruments provide essential guidelines for sustainable resource management. In developing the South China Sea National Marine Park, all resource utilization must prioritize sustainability to prevent overexploitation and depletion. Legal frameworks can establish conditions and standards for resource use, such as fishing quotas and technical requirements for marine energy development. Concurrently, laws should mandate monitoring and evaluation mechanisms for resource utilization activities to prevent irreversible damage to marine ecosystems. By implementing environmental impact assessment systems, resource utilization projects can undergo rigorous scientific evaluation to ensure compliance with ecological conservation requirements (Chen and Liu, 2022).

Rule of law instruments can also reconcile conflicts between ecological conservation and resource utilization through legal frameworks. In developing the South China Sea National Marine Park, ecological protection and resource utilization often present competing interests. For instance, fisheries operations may conflict with marine ecological conservation objectives. Legal instruments such as ecological compensation systems can establish benefit-sharing mechanisms to compensate stakeholders affected by conservation efforts. Simultaneously, laws can clarify rights and obligations to balance competing interests, ensuring ecological protection does not unduly restrict legitimate resource use. By establishing legal frameworks for marine resource use rights, the legitimacy and boundaries of resource utilization can be statutory defined, preventing disputes arising from resource competition (Chen et al., 2025).

Rule of law instruments can also enhance public awareness and support for ecological conservation and rational resource utilization through legal advocacy and education. In developing the South China Sea National Marine Park, public participation and oversight serve as crucial safeguards for achieving a balance between environmental protection and resource management. Legal advocacy and educational programs can strengthen public ecological consciousness, fostering understanding of the interdependence between conservation and sustainable resource use. Furthermore, law can establish incentive mechanisms to encourage public engagement in conservation oversight, such as implementing reporting systems and reward programs for monitoring and reporting illegal activities (Ying, 2019).

Coordinating the relationship between ecological conservation and rational resource utilization through rule of law instruments constitutes a critical task in developing National Marine Parks in the South China Sea. Rule of law mechanisms not only provide legal safeguards for ecological protection but also establish norms and boundaries for resource utilization, thereby ensuring the sustainable development of marine ecosystems.

3.2.2 Establishing regional cooperation and dispute settlement mechanisms

The establishment of the South China Sea National Marine Park involves complex international relations and regional interest patterns, making the development of effective legal mechanisms for regional cooperation and dispute resolution essential. Theoretically, such cooperative frameworks should be grounded in international law while balancing the practical needs and interests of all parties. The core of such mechanisms lies in

achieving binding agreements through multilateral negotiations, clarifying rights and obligations in marine park management. Specifically, provisions from the United Nations Convention on the Law of the Sea (UNCLOS) regarding marine environmental protection and biological resource conservation could serve as references. Tailored to the unique characteristics of the South China Sea region, specialized regional legal instruments should be formulated to encompass marine ecological protection standards, rules for resource development and utilization, and scientific research collaboration mechanisms, thereby providing clear guidelines for all stakeholders.

In terms of dispute resolution, while traditional international mechanisms such as the International Court of Justice (ICJ) or the International Tribunal for the Law of the Sea (ITLOS) possess authority, they may face implementation challenges in the South China Sea. Therefore, more flexible and pragmatic dispute resolution approaches need to be explored. A viable approach involves establishing a multilevel dispute resolution framework comprising preventive measures, consultation mechanisms, and third-party mediation. Preventive measures primarily involve information sharing and joint monitoring to reduce misunderstandings and conflicts. Consultation mechanisms emphasize regular inter-party meetings and dialogues to resolve differences, while third-party mediation introduces neutral intermediaries to assist in disputes where negotiations have stalled. This multilevel framework can adapt to disputes of varying natures and complexities, thereby enhancing resolution efficiency.

From a technical legal perspective, the design of regional cooperation mechanisms must address the existing sovereignty disputes in the South China Sea. A potential solution involves adopting a "functional cooperation" model, where coastal states collaborate on specific marine conservation initiatives without addressing sovereignty controversies. This could be implemented through a Joint Management Committee, where representatives from relevant states jointly decide on marine park management while preserving their respective sovereignty assertions. Such a model facilitates practical cooperation without compromising legal positions. Mechanism design should also emphasize adaptability, allowing state parties to adjust cooperation scope and methods based on actual conditions, thereby avoiding rigid institutional arrangements that impede progress.

At the implementation level, the effectiveness of regional cooperation legal mechanisms depends on political will and enforcement capacity among state parties. To this end, mechanism design should incorporate incentives such as technical assistance and financial support to encourage active participation and obligation fulfillment. Concurrently, establishing monitoring and evaluation systems is crucial to regularly assess progress and outcomes, ensuring effective enforcement of legal frameworks. Notably, regional cooperation should extend beyond governmental levels by engaging research institutions, NGOs, and other stakeholders, fostering a multi-stakeholder governance framework. This inclusive approach enhances cooperation sustainability by leveraging diverse expertise and resources.

In the long term, the legal framework for regional cooperation within the South China Sea National Marine Park should be integrated with broader marine governance systems. As regional economic integration and environmental protection collaboration deepen, the park can serve as a testing ground to explore more sophisticated models of regional ocean governance. Successful experiences from this model could then be extended to other maritime cooperation initiatives, ultimately contributing to the establishment of a comprehensive and systematic governance system for the South China Sea region (Tang et al., 2023). Throughout this process, legal mechanism must maintain dynamic adjustment capabilities to adapt to evolving regional dynamics and international environments.

The regional cooperation legal framework and dispute resolution mechanisms for National Marine Park in the South China Sea must balance legal principles with practical feasibility, adopting flexible and diverse cooperative models while respecting fundamental rules of international law. By establishing a multilevel and inclusive legal structure, complemented by effective implementation and oversight mechanisms, robust rule of law safeguards can be provided for the sustainable development of marine parks, simultaneously accumulating valuable experience for regional marine governance (Tang et al., 2023).

4 Framework design for rule of law safeguards in Nanhai National Marine Park

4.1 Enhancement of domestic legal system

4.1.1 Formulation of special legislation and supporting regulations

To establish a rule of law safeguard system for the Nanhai national marine park, priority should be given to formulating specialized legislation and supporting regulations. While the current Marine Environmental Protection Law provides a fundamental legal basis for marine conservation, it still lacks institutional mechanisms for managing national marine protected areas. The core objective of revising this law is to create a management framework for national marine reserves with Chinese characteristics, clarifying establishment criteria, administrative authority, and regulatory procedures to lay the groundwork for subsequent specialized legislation. Such institutional innovation requires not only drawing on international advanced practices but also integrating the unique geopolitical and ecological features of the South China Sea, ultimately developing operational legal norms that effectively address regional challenges.

The development of specialized legislation for National Marine Parks in the South China Sea holds urgent practical necessity. As a unique marine conservation area, this park serves dual purposes of ecological protection and sustainable resource utilization, requiring its legal framework to transcend traditional conservation models. The specialized legislation should systematically outline core elements including planning principles, functional zoning, and access control systems, while establishing coordination mechanisms with related industries such as fisheries, shipping,

and tourism. In terms of legislative approach, it is recommended to adopt a "framework law + implementation rules" model, which maintains legal stability while allowing timely adjustments to specific management measures through supporting regulations (Chen and Liu, 2022). This legislative technique can effectively respond to the dynamic changes of ecological environment and the evolution of management needs in the South China Sea (Huang et al., 2024).

The design of supporting regulatory frameworks should emphasize synergies across three dimensions. At the technical standards level, it is essential to establish normative documents for marine ecological monitoring and restoration technologies, providing scientific foundations for park management. At the operational level, detailed enforcement protocols, penalty criteria, and supervision mechanisms must be formulated to ensure legal compliance. At the coordination level, cross-departmental and cross-regional collaboration systems should be established to resolve jurisdictional conflicts in marine environmental governance (Wang J. et al., 2023). These supporting regulations together constitute a complete legal implementation network, enabling park management to combine macro-level guidance with micro-level operational tools (Zhu et al., 2022).

The formulation of specialized legislation and supporting regulations must also ensure alignment with existing legal system. On one hand, it should maintain coordination with maritime-related laws such as the Fisheries Law and the Island Protection Law to prevent regulatory conflicts. On the other hand, it needs to balance central legislation and local legislation by granting appropriate autonomy to local governments while preserving national unified management (Wang, 2022). Meanwhile, legislation should also be made consistent with China's obligations under the United Nations Convention on the Law of the Sea (UNCLOS) and respect the rights enjoyed by other countries. We propose that Article 194 of the Convention regarding measures to prevent, reduce and control pollution of the marine environment could be translated into corresponding specialized legislative provisions. And given the unique characteristics of the South China Sea waters, consideration could be given to establishing "special provisions for ecological protection in the South China Sea". This systematic approach can ensure that the legal framework of Nanhai National Marine Park is both authoritative and flexible.

4.1.2 Construction of law enforcement mechanism and supervision system

Establishing an efficient law enforcement mechanism and rigorous regulatory framework constitutes the cornerstone of rule of law safeguards for the Nanhai National Marine Park. The primary task involves clarifying the authority and responsibilities of law enforcement entities while developing a multi-agency collaborative governance model. Given that marine park management encompasses multiple administrative bodies including marine affairs, environmental protection, fisheries, and coast guard authorities, legislation should define clear jurisdictional boundaries and coordination protocols to prevent fragmented oversight or regulatory gaps. Drawing lessons from national park system reforms, establishing a specialized integrated law enforcement agency could be implemented to consolidate administrative penalty powers and supervisory inspection functions under unified authority.

In terms of law enforcement capacity building, priority should be given to upgrading technical equipment and expanding professional talent reserves. Modern marine law enforcement requires intelligent monitoring technologies such as satellite remote sensing, drone patrols, and underwater robots to establish an integrated "air-space-land-sea" regulatory network. The application of modern intelligent monitoring technologies and equipment should be strengthened, such as adopting an integrated solution that combines "Tiangong" satellite remote sensing data (with a resolution of up to 0.8 meters) and unmanned aerial vehicle (UAV) patrols (e.g., the Wing Loong-2H maritime search and rescue variant). Additionally, by leveraging the practical law enforcement experience of the China Coast Guard in the South China Sea, research can be conducted to establish a regular mechanism for joint maritime, aerial, and land law enforcement, as well as a blacklist system for foreign fishing vessels engaged in illegal fishing and infringement activities (Li, 2024). Concurrently, specialized marine enforcement teams must be established to conduct regular training sessions and emergency drills, improving rapid response capabilities against illegal fishing, pollution discharge, and other unlawful activities. During enforcement processes, emphasis should be placed on evidence documentation and procedural compliance to ensure administrative penalty decisions withstand judicial scrutiny.

The construction of the regulatory system needs to realize full-process closed-loop management. The ex-ante supervision should improve the planning and approval system, and implement strict environmental impact assessment for the construction projects in the marine park (Liu et al., 2022); In-process supervision should establish a regular inspection mechanism, and use big data analytics technology to dynamically monitor ship tracks, fishery activities, and other maritime operations (Wang J. et al., 2023). Ex-post supervision must strengthen law enforcement accountability by establishing ecological damage compensation systems and imposing severe penalties for marine ecological destruction. Particular emphasis should be placed on enhancing supervision over cross-border pollution and illegal fishing through improved law enforcement cooperation mechanisms with neighboring countries.

The daily supervision should adopt a multi-stakeholder governance model. In addition to administrative supervision, a public reporting reward system can be established to encourage the participation of social forces such as fishermen and environmental organizations in supervision (Chen, 2023). At the same time, information disclosure system should be implemented to regularly publish marine environmental quality bulletins and law enforcement inspection reports, subjecting governance to public scrutiny (Liu and Ji, 2025). For highly professional regulatory matters, third-party institutions can be entrusted to carry out independent assessments to ensure the objectivity and fairness of regulatory results.

The improvement of the technical standard system is also an important support for regulatory efforts. It is necessary to formulate unified standards for marine ecological monitoring and standardize the detection methods of water quality, biodiversity and other indicators (Peng et al., 2024). At the same time, technical specifications for ecological damage identification and assessment should be established to provide a scientific basis for law enforcement and punishment (Ma, 2020). These standards should be in line with international standards to facilitate interregional data comparison and collaborative governance.

Finally, it is essential to establish an enforcement effectiveness evaluation mechanism. This involves conducting regular statistical analysis of law enforcement cases to assess legal implementation outcomes and promptly identify institutional loopholes. This can be achieved by establishing a law enforcement satisfaction evaluation system to collect feedback from regulated entities, thereby continuously optimizing enforcement approaches. The evaluation results should serve as crucial references for improving enforcement practices and legislative refinement, thereby forming a virtuous cycle of "legislation-enforcement-evaluation".

4.1.3 Institutionalization mechanism of adaptive governance instruments

The institutionalization mechanism of adaptive governance instruments constitutes an indispensable component of the law-based governance safeguards framework for the Nanhai National Marine Park. Through institutional design, adaptive governance tools such as ecological fiscal transfer payment mechanisms and multi-stakeholder oversight platforms can be transformed into legally binding institutional arrangements, thereby providing robust institutional support for the ecological protection and sustainable development of national marine parks in the South China Sea.

The ecological fiscal transfer payment mechanism serves as a vital instrument for achieving ecological conservation and economic equilibrium. By providing financial compensation to ecologically protected regions, this system safeguards their economic growth from being hindered by environmental protection efforts. In the context of the Nanhai National Marine Parks development, this mechanism can be institutionalized as long-term stable funding model to offset economic losses arising from development restrictions or withdrawal from certain economic activities. Such institutional design not only motivates local governments and stakeholders to actively participate in ecological preservation, but also ensures adequate financial support for the parks construction and management (Xu S. et al., 2025).

The institutionalized mechanism of the multi-stakeholder supervision platform can effectively integrate diverse forces to achieve collaborative governance. The construction of the Nanhai National Marine Park involves multiple interests and demands from governments, enterprises, research institutions, and the public. Establishing multi-stakeholder supervision platform enables information sharing, transparent decision-making, and interest coordination. Such institutional design not only enhances governance efficiency but also strengthens public support and participation in the park construction. Furthermore, these platforms incorporate regular evaluation and feedback mechanisms to promptly identify and resolve governance challenges, thereby ensuring the realization of national marine park construction objectives.

The institutionalization mechanisms of adaptive governance instruments also manifest in their flexibility and diversity. The ecosystems of the Nanhai National Marine Park exhibit high complexity and sensitivity, with distinct ecological characteristics and development needs across different regions. Therefore, these tools must possess the capacity for flexible adjustments tailored to specific circumstances. In ecological fiscal transfer payment mechanisms, differentiated compensation criteria can be designed based on regional ecological significance and economic development levels. Similarly, multi-stakeholder monitoring platforms can incorporate diverse participation modalities aligned with the distinct characteristics of various stakeholders. For example, relevant rules can be formulated to require vessels navigating within national marine parks to use green fuels (Jiang et al., 2025), improve the supply chain for green vessel fuels within the parks (C. Xu et al., 2025), and establish a supervision and management mechanism for the use of green fuels at relevant land ports (Guo et al., 2025). This flexibility and diversity constitute the essence of institutional design for adaptive governance instruments and serve as crucial determinants for the successful development of Nanhai National Marine Park (Chen et al., 2025).

The institutionalization mechanisms of adaptive governance instruments also require emphasis on the alignment and coordination between laws and policies. In the development of the Nanhai National Marine Park, the institutional design of ecological fiscal transfer payment mechanisms and multi-stakeholder supervision platforms must align with relevant domestic laws and policies to ensure their effective operation within legal frameworks. Specifically, the ecological fiscal transfer payment mechanisms need to integrate with laws such as the Marine Environmental Protection Law to clarify the legal status and scope of application. Similarly, the multi-stakeholder supervision platforms need alignment with environmental protection legislation like the Environmental Protection Law to guarantee the legitimacy and effectiveness of its oversight functions. Such legal-policy alignment and coordination constitute critical safeguards for the smooth implementation of adaptive governance instrument institutionalization mechanisms (Wang, 2022).

4.2 Establishment of international legal cooperation mechanism

4.2.1 Signing and implementation of regional marine protection agreements

The signing and implementation of regional marine protection agreements constitute a crucial component in establishing the law-based governance safeguard system for the Nanhai National Marine Park. This process requires thorough consideration of the unique geopolitical environment and ecological vulnerability of the South

China Seas, aiming to achieving joint conservation objectives through effective integration of international legal frameworks and regional cooperation mechanisms. Theoretically, such agreements should be formulated based on the fundamental principles of international law of the sea while balancing the practical interests of all stakeholders within the region.

The United Nations Convention on the Law of the Sea (UNCLOS) provides a fundamental legal framework for regional marine conservation, with its relevant provisions on marine environmental protection and biological resource conservation offering significant guidance. In the South China Sea region, the Convention's principles of "common but differentiated responsibilities" and the "precautionary principle" can be integrated to establish a conservation mechanism tailored to regional characteristics. Specifically, the agreement should include core elements such as marine biodiversity protection, pollution prevention and control, and ecological restoration, while clearly defining the rights and obligations of each contracting party. Regarding the establishment of conservation standards, internationally recognized management norms for marine protected areas can be referenced, combined with the unique features of the South China Sea ecosystem to develop region-specific conservation measures.

The establishment of regional cooperation mechanisms serves as a crucial safeguard for ensuring the effective implementation of agreements. Existing platforms such as the ASEAN-China Maritime Dialogue Mechanism can serve as foundations to further deepen cooperation in marine environmental protection. These mechanisms should incorporate concrete elements like regular consultations, information sharing, and joint monitoring to establish institutionalized collaboration models. At the operational level, establishing a joint law enforcement mechanism could be considered, leveraging technological means to enhance regulatory capabilities, such as utilizing satellite remote sensing technology for large-scale monitoring (Wang J. et al., 2023). At the same time, a scientific evaluation system should be established to periodically evaluate the effect of protection and adjust the protection strategy based on the evaluation results (Zhang et al., 2024).

In the long term, the signing and implementation of regional marine protection agreements will not only enhance ecological conservation in the South China Sea but also create a new platform for regional cooperation. By jointly conserving the marine environment, all parties in the region can strengthen mutual trust and lay the foundation for collaboration in other fields. Regarding agreement design, flexibility should be incorporated to adapt to emerging circumstances and challenges. Simultaneously, alignment with global environmental conventions must be prioritized to ensure regional conservation efforts are consistent with global environmental objectives. This multi-tiered and multi-dimensional conservation system will provide a robust legally institutionalized safeguard for the sustainable development of National Marine Parks in the South China Sea.

4.2.2 Optimization of the international dispute settlement mechanism

The deficiencies of existing international dispute resolution mechanisms in South China Sea marine conservation primarily manifest in their applicability, efficiency, and impartiality. Marine conservation in the South China Seas involves complex ecological, resource-related, and economic interests that existing mechanisms struggle to fully address. Dispute resolution procedures often prove lengthy, yet marine conservation in the region demands rapid response and timely intervention to prevent further ecological degradation. Moreover, weak enforcement and inadequate supervision or sanction measures under existing frameworks hinder effective dispute resolution.

To address these issues, optimizing the international dispute resolution mechanism can be approached through the following measures. First, a specialized marine conservation dispute resolution mechanism should be established with clearly defined scope and procedures. This mechanism should prioritize ecological principles, placing the integrity and sustainability of marine ecosystems at the core of conflict resolution. Second, multilateral consultation frameworks could be introduced to encourage dialogue and cooperation among relevant states, thereby preventing escalation. Third, enhanced alignment between international and domestic law is essential to ensure operational feasibility within national legal systems (Chen et al., 2025).

Simultaneous with mechanism optimization, transparency and impartiality must be prioritized. This could involve establishing independent expert panels or international tribunals to deliver impartial rulings with enforceable outcomes. Robust oversight of dispute resolution processes is also critical to balance competing interests and prevent unilateral dominance from undermining regional collective interests. Optimizing efforts should further emphasize regional cooperation as a catalytic force. By establishing regional marine protection platforms, states can enhance collaboration in information sharing, joint law enforcement, and collective decision-making, thereby creating a more solid foundation for dispute resolution. Such cooperative frameworks not only improve the efficiency of conflict resolution but also strengthen mutual trust, laying the groundwork for long-term stability and sustainable development in South China Sea marine conservation.

The optimization of the international dispute resolution mechanism is a crucial component in establishing the legally institutionalized safeguard system for the Nanhai National Marine Park. By refining institutional frameworks, strengthening regional cooperation, and enhancing enforcement capabilities, international disputes related to marine conservation in the South China Sea can be effectively resolved, providing robust support for achieving regional ecological security and sustainable development.

4.3 Implementation pathways for rule of law safeguards

4.3.1 Phased advancement of rule of law safeguards

The development of rule of law for the Nanhai National Marine Park requires a phased advancement strategy to ensure the systematic improvement and implementation of legal systems.

Phased advancement not only clarifies objectives and tasks for each stage but also enables timely strategy adjustments based on practical conditions, enhancing the scientific validity and feasibility of rule-of-law development.

The first phase focuses on establishing the foundational legal framework. The core task of this phase is to formulate specialized legislation for National Marine Parks in the South China Sea, defining their legal status, management objectives, protection scope, and fundamental regulatory principles. Specialized legislation should encompass ecological conservation, resource utilization, and supervision mechanisms while aligning with relevant laws and regulations (e.g., Marine Environmental Protection Law, Fisheries Law). Supporting regulations must also be developed to refine management measures, such as ecological compensation mechanisms and environmental impact assessment systems, ensuring legal operability. Key tasks in this phase include establishing an initial enforcement framework, clarifying enforcement entities and their responsibilities, and laying the groundwork for subsequent supervision and law enforcement.

The second phase focuses on refining legal implementation and regulatory frameworks. Following the enactment of specialized legislation and supporting regulations, efforts shift to enforcement and oversight. This phase requires strengthening law enforcement capabilities through personnel training, equipment provision, and procedural standardization. Simultaneously, a multi-department collaborative supervision mechanism should be established to integrate oversight capacities from marine, environmental protection, and fisheries departments, thereby avoiding inefficiencies caused by fragmented management. Modern technologies such as remote sensing monitoring and big data analytics can be introduced to enhance the precision and efficiency of regulatory operations (Wei et al., 2023). Public participation mechanism should also be prioritized to encourage social forces to participate in supervision, and improve the transparency and credibility of law implementation (Chen, 2023).

The third phase focuses on strengthening international legal cooperation and dispute resolution mechanisms. Given the multi-national interests in the South China Seas, rule-of-law development must consider international law applicability. The primary task of this phase is to promote the signing of regional marine protection agreements, clarifying the rights and obligations of each state in marine park management. Simultaneously, international dispute resolution mechanisms should be optimized through diplomatic negotiations, international arbitration, and other methods. Domestic laws can draw on international experiences, such as provisions under the United Nations Convention on the Law of the Sea (UNCLOS), to ensure alignment between national legislation and international norms while safeguarding national interests.

The fourth phase involves rule-of-law evaluation and dynamic adjustment. The development of the legal system is not a one-time effort but requires ongoing refinement based on implementation outcomes. This phase should establish a scientific rule-of-law evaluation framework to regularly monitor and assess the effectiveness of law enforcement, including indicators such as ecological conservation achievements, administrative efficiency, and public satisfaction. Based on evaluation results, timely revisions to legal provisions or adjustments to management measures should be made to adapt to changes in the South China Seas ecological environment and evolving international dynamics. Concurrent efforts in rule-of-law education and publicity will enhance societal awareness of marine protection, fostering a long-term stable legal environment.

The essence of phased rule-of-law advancement lies in its incremental approach, ensuring clear objectives, feasible measures, and continuous optimization through practice. Through this strategy, the rule-of-law safeguard system for National Marine Parks in the South China Sea will gradually mature, ultimately achieving a balance between ecological protection and sustainable development.

4.3.2 Public participation and educational outreach

Public participation constitutes a critical component in the legally institutionalized safeguard system for National Marine Parks in the South China Sea. Its core value lies in fostering a multi-stakeholder co-governance framework for marine ecological protection through broad societal engagement. Public participation not only strengthens the social foundation for law enforcement but also enhances collective awareness and initiative in marine environmental conservation. From a legal perspective, the public's right to environmental participation, recognized as an integral component of environmental rights in laws such as the Environmental Protection Law, requires substantial practical enhancement in marine conservation contexts. Given the South China Sea's unique ecological significance and strategic importance, conservation efforts demand active mobilization of cross-sectoral stakeholders to establish a government-led, multi-party collaborative governance model.

In terms of public education, a systematic and institutionalized marine ecological legal education framework must be developed. This entails firstly improving marine environmental education legislation by integrating ecological conservation into national education systems - cultivating youth awareness through school curricula and specialized educational materials. Secondly, innovative communication platforms should be leveraged, particularly digital media, to deliver interactive, accessible scientific outreach content. Research demonstrates a positive correlation between public understanding of marine ecosystems and conservation willingness, making cognitive enhancement a prerequisite for effective protection. Some successful domestic cases have also accumulated experience in enhancing public participation and educational outreach. For instance, the science popularization campaign titled "Guardians of the Beibu Gulf: The Ocean Thrives with Your Presence", organized by the Guangxi Marine Environmental Monitoring Center Station, was honored as one of the top ten national cases for public participation. This initiative stands out for three key highlights: First, it established science education bases to strengthen offline interactive experiences in science popularization. Second, it leveraged the "Internet + Science Popularization" approach to build a new media matrix for science communication. Third, it explored a multi-departmental and cross-industry collaborative mechanism for science popularization. Through an integrated model combining "science education bases + online dissemination + practical participation + cross-departmental collaboration", it transformed

ocean conservation awareness into conscious public actions, fostering a governance framework characterized by government guidance, social coordination, and public participation (Cen and Li, 2024).

The design of public participation mechanisms should prioritize practical effectiveness and operational feasibility. A multi-tiered engagement framework could be established, including information disclosure systems, public hearing procedures, and volunteer service programs. Decision-making processes must guarantee public access to information and participation rights concerning marine park planning and development. Implementation phases should involve citizens in specific tasks such as ecological monitoring and patrols, while supervision mechanisms require accessible reporting channels to encourage public participation in monitoring illegal activities. This comprehensive participatory model not only enhances decision-making scientific rigor but also strengthens the credibility of legal enforcement.

Tailored participation strategies should be implemented based on the distinct characteristics of different groups. Coastal communities require capacity-building in sustainable marine resource utilization, while corporate entities need strengthened environmental responsibility awareness to adopt eco-friendly production practices. Scientific institutions should be encouraged to conduct technological studies on marine ecological conservation, providing scientific support for legal system development. Special attention must be paid to fishermen and other affected groups, balancing conservation and development through ecological compensation mechanisms to reduce policy implementation resistance.

By organizing people-to-people exchange programs, mutual understanding among citizens of South China Sea neighboring countries can be enhanced, fostering a supportive social environment for regional marine conservation cooperation. This "second-track diplomacy" approach may alleviate geopolitical tensions to some extent, creating external conditions conducive for marine park development. It is crucial to note that public participation must be conducted within the framework of the rule of law – ensuring both the protection of participation rights and the regulation of conduct to prevent disorderly involvement from disrupting the normal progress of conservation efforts.

The enhancement of educational outreach effectiveness requires scientific evaluation mechanism. Regular assessments of public marine conservation awareness through surveys and behavioral observations can inform strategy adjustments (Chen and Lin, 2022). It is equally important to emphasize the exploration and application of traditional knowledge, integrating local ecological wisdom with modern conservation concepts to develop regionally distinctive marine cultures. The establishment of such cultural identity can fundamentally enhance public awareness of conservation efforts, thereby laying a solid cultural foundation for legally institutionalized safeguards.

4.3.3 Establishment of an integrated legal implementation framework

Establishing a comprehensive legal implementation framework constitutes the core mission of legal safeguards for the South China Sea National Marine Park. This framework requires integrating multiple elements to ensure scientific rigor, practical feasibility, and effective governance. **Evidence-based planning** serves as a crucial component of this framework. This approach emphasizes using scientific data and research findings as foundations, conducting systematic assessments of the current status, functions, and potential risks of the South China Seas marine ecosystem to formulate targeted conservation and management measures. By analyzing the health conditions of key ecosystems such as coral reefs and mangroves in the South China Sea, combined with climate change impacts and human activities, solid scientific foundations for legal frameworks will be established. Moreover, evidence-based planning demands dynamic regulatory adjustments that allow timely revisions based on ecological changes and management feedback, thereby adapting to evolving conservation needs.

The **risk-adaptive licensing system** constitutes another crucial component of the framework. At its core, this mechanism enforces strict controls on activities entering the South China Sea National Marine Park through categorized management and tiered approval processes (Xiao et al., 2025). For high-risk operations such as fishing and offshore hydrocarbon development, clear entry criteria and environmental impact assessments must be established to ensure ecological preservation. The system also requires flexible regulatory mechanisms that enable differentiated management approaches tailored to regional ecological sensitivity and resource endowments, thereby achieving a balance between ecological conservation and sustainable resource utilization.

The **technology-driven monitoring system** provides essential operational support. By integrating advanced technologies such as satellite remote sensing, artificial intelligence, and the Internet of Things (IoT) networks, a comprehensive, high-precision monitoring network to track real-time ecological dynamics and human activities in the park can be established. Remote sensing technology is employed to monitor marine pollution and illegal sand mining, while sensor networks continuously track critical indicators like water quality and temperature. This integrated approach provides timely and accurate data support for effective law enforcement (Xu et al., 2024). Technology-driven monitoring system can not only improve the efficiency of supervision but also provide scientific basis for the dynamic adjustment of laws and ensure the implementation effect of laws.

Ecosystem restoration programs serve as crucial complements to the framework. To address ecological degradation issues in the South China Sea, such as coral bleaching and mangrove loss, scientifically sound restoration strategies must be developed. Measures such as artificial coral cultivation and mangrove rehabilitation gradually restore damaged ecosystems, enhancing ecological functionality and stability. Furthermore, these restoration programs should be closely integrated with legal frameworks to clarify responsibilities, funding sources, and implementation mechanisms, ensuring the continuous advancement of restoration efforts.

This integrated legal implementation framework, through integrating evidence-based planning, risk-adaptive licensing systems, technology-driven monitoring mechanisms, and ecosystem restoration programs, not only provides scientific foundations and

practical guidance for the rule of law in the Nanhai National Marine Park but also advances China's marine ecological civilization development. Moreover, under the context of strategic competition, this framework offers a standardized blueprint for managing disputed maritime areas, laying a solid foundation for achieving regional sustainable development and international cooperation.

5 Potential challenges and countermeasures for legally institutionalized safeguards in Nanhai National Marine Park

5.1 Potential challenges

5.1.1 The complexity of sovereignty disputes and regional cooperation

The South China Sea sovereignty dispute stands as a pivotal issue in regional maritime governance, its complexity stemming from the historical entanglement of overlapping territorial claims and contemporary maritime rights demands. From an international law perspective, while the United Nations Convention on the Law of the Sea (UNCLOS) establishes exclusive economic zones and continental shelf systems for coastal states, fundamental disagreements persist among South China Sea neighbors regarding island sovereignty and maritime delimitation. These disputes directly constrain the depth of transnational marine conservation cooperation, making any ecological governance initiatives in disputed waters susceptible to being interpreted as either reinforcing or undermining sovereignty assertions. When national marine park planning overlaps with disputed maritime areas, the applicability of relevant legal provisions faces severe challenges, potentially triggering concerns about "the politicization of ecological conservation measures". If marine park boundaries involve waters surrounding islands under foreign control, this could provoke diplomatic protests or confrontational enforcement actions, ultimately prioritizing geopolitical competition over ecological protection objectives.

The obstacles to regional cooperation are also reflected in the varying priorities countries place on marine resource development. Some coastal states regard fishing and oil/gas exploration as pillars of their national economies, with domestic laws often prioritizing resource utilization over ecological conservation. This interest-driven legislative tendency makes it difficult for countries to reach consensus on marine park management systems. Specific provisions such as protection intensity, fishing zone boundaries, and scientific monitoring standards may be weakened due to economic considerations. What's more, the South China Sea serves as a vital global shipping corridor, thereby environmental protection measures must balance navigation freedom principles, which significantly increasing coordination challenges.

5.1.2 Challenges in law enforcement and supervision

The enforcement and supervision of the South China Sea National Marine Park may face multifaceted practical challenges, primarily stemming from the natural characteristics of the marine area and the complexity of its management system. The vast expanse of South China Sea waters, coupled with its intricate geographical conditions, presents significant spatial challenges for law enforcement operations. Law enforcement agencies must cover an extensive marine area, yet existing resources often fall short in meeting the demands for round-the-clock, comprehensive surveillance. This supply-demand imbalance will result in inefficient enforcement and weak deterrent effects. Furthermore, the harsh natural conditions of the South China Sea, with frequent occurrences of extreme weather like typhoons and monsoons, will further increase the difficulty and risks of law enforcement activities.

From a technical standpoint, inadequate regulatory measures remain a critical barrier to effective law enforcement. Traditional maritime patrol methods are costly and inefficient, while modern monitoring technologies like satellite remote sensing and drone surveillance have yet to achieve full adoption or overcome technical bottlenecks. The uneven distribution of law enforcement resources will further complicate regulatory efforts. Limited enforcement capacity tends to concentrate in coastal areas with fewer disputes, while oversight of distant waters and reef zones remains relatively weak. This imbalanced resource allocation creates opportunities for violators to exploit regulatory gaps by conducting illegal activities in under-regulated regions. Moreover, coordination among law enforcement agencies is problematic. Multiple departments - including marine affairs, environmental protection, and fisheries - operate independently without unified command or information-sharing mechanisms, resulting in inefficient enforcement. Such fragmented management systems struggle to address the increasingly complex challenges of marine environments.

In summary, the legal enforcement and supervision of the South China Sea National Marine Park present a systemic challenge that requires coordinated efforts across multiple dimensions. Only by fully understanding these difficulties can we develop practical solutions to ensure long-term protection of the South China Seas ecological environment.

5.2 Possible countermeasures

5.2.1 Strengthening the coordination between domestic and international law

Enhancing the coordination between domestic and international law is crucial for establishing legal safeguards in the South China Sea National Marine Park. The alignment of domestic legislation with international norms not only protects national maritime rights but also impacts regional ecological conservation and international cooperation effectiveness. To achieve this, China must proactively integrate international legal standards into its domestic framework, ensuring consistency between its legal system and global marine protection regulations. Specifically, this can be accomplished by revising fundamental laws like the Marine Environmental Protection Law, translating core principles from international treaties such as the United Nations Convention on the Law of the Sea into domestic provisions. Such adaptation aligns

Chinas legal framework with internationally recognized standards in marine conservation and resource management. This transformation not only enhances the international applicability of Chinese law but also strengthens its legal capacity to participate in global maritime affairs.

From a legislative technical perspective, emphasis should be placed on the compatibility and flexibility of legal provisions. On one hand, domestic legislation must explicitly adopt internationally recognized marine conservation terminology and definitions to prevent legal application conflicts arising from conceptual discrepancies. When defining the scope and functions of "marine protected areas", reference should be made to the relevant standards of the Convention on Biological Diversity to ensure alignment between domestic classifications and international protection systems. On the other hand, legislative processes should reserve appropriate flexibility to facilitate timely adjustments according to evolving developments in international maritime law. This dynamic adjustment mechanism enables domestic legislation to maintain sensitivity to changing global circumstances, thereby avoiding the issue of domestic laws lagging behind updates in international legal frameworks.

In terms of legal implementation, establishing a coordinated enforcement mechanism between international and domestic law is crucial. This involves improving procedures for applying international treaties domestically and clarifying the direct legal effect of international rules in domestic judicial practice. Simultaneously, domestic law enforcement agencies should enhance their understanding and application capabilities regarding international marine conservation regulations through professional training and technical guidance to improve officers' international legal literacy. A dedicated international legal coordination body could be established to address specific issues related to the integration of international and domestic law, thereby providing legal support for the management of the South China Sea National Marine Park.

In dispute resolution, improving the alignment between domestic laws and international mechanisms holds particular significance. Domestic legislation should explicitly define applicable legal rules and procedural options for international maritime disputes, thereby establishing institutional safeguards for peaceful conflict resolution. Relevant laws could establish a principle prioritizing diplomatic approaches like negotiation and mediation, while retaining the right to resort to international judicial or arbitration procedures. This institutional design not only demonstrates respect for international law but also preserves national autonomy in handling maritime affairs.

Enhancing legal coordination requires prioritizing the development of regional cooperation frameworks. The legal safeguards for the South China Sea National Marine Park cannot rely solely on unilateral legislation but should establish regional cooperation mechanisms through bilateral or multilateral agreements. This includes formulating unified marine conservation standards, establishing joint enforcement procedures, and improving information-sharing mechanisms. In terms of agreement content, particular attention should be paid to harmonizing domestic laws with international law. By creating permanent institutions such as a Legal Coordination Committee, continuous efforts should be made to promote integrated development of the regional legal system. Meanwhile, consideration could also be given to establishing a "dispute prevention mechanism" and introducing a "pre-assessment procedure for ecological impacts in the South China Sea", requiring that any resource development project undergo review by an environmental expert committee or a designated *ad hoc* body.

5.2.2 Improve law enforcement capacity and international cooperation

Enhancing law enforcement capabilities and international cooperation forms a crucial component of legal safeguards for the South China Sea National Marine Park. To strengthen enforcement capacity, priority should be given to cultivating specialized talent pools with expertise in marine conservation, legal knowledge, and operational skills. By refining training systems and organizing regular professional courses with hands-on drills, we can improve officers' ability to handle complex marine environments and manage emergencies. Technological innovation serves as a key driver for progress. Implementing smart monitoring systems through remote sensing, big data analytics, and AI technologies enables round-the-clock oversight of the park, boosting both efficiency and precision. Furthermore, deploying drones and unmanned vessels for maritime patrols helps promptly detect and deter illegal activities like unauthorized fishing and sand mining.

In terms of international cooperation, the development of the South China Sea National Marine Park requires establishing close partnerships with neighboring countries and regions. It is essential to promote the signing and implementation of regional marine protection agreements, clarifying the rights and obligations of all parties in marine ecological conservation, resource utilization, and law enforcement cooperation, thereby building a mutually beneficial partnership mechanism. Establishing joint law enforcement mechanisms through coordinated maritime operations such as joint patrols and investigations will effectively address cross-border violations. By developing information-sharing platforms, countries can enhance collaboration in exchanging enforcement data, monitoring results, and best practices. Actively participating in international ocean governance and advancing the domestic application of international legal instruments like the United Nations Convention on the Law of the Sea will strengthen Chinas influence and voice in South China Sea marine conservation affairs.

6 Conclusions

The legal framework for the South China Sea National Marine Park faces a fundamental dilemma: balancing ecological conservation with geopolitical realities. This equilibrium not only safeguards marine ecosystem integrity but also determines the depth and scope of regional cooperation. Theoretically, legal innovations must balance ecological values with political feasibility, designing institutional mechanisms to transform national marine programs

into dual platforms for ecological protection and trust-building. This institutional design requires unique characteristics that satisfy both the intrinsic needs of ecosystems and adapt to complex geopolitical environments. Ecological integrity demands the establishment of rigorous legal standards for environmental protection. However, an overemphasis on ecological protection alone may struggle to align with current geopolitical realities. The South China Sea involves sovereignty claims from multiple coastal states, making any unilateral conservation measures politically sensitive. Therefore, legal frameworks must demonstrate political wisdom by positioning marine parks as regional cooperation platforms rather than exclusive management tools. The dual-function legal framework manifests in practice through a "protection + cooperation" composite model. On one hand, domestic legislation clarifies protection objectives and standards while establishing rigorous enforcement systems. On the other hand, international agreements create cooperative frameworks that form multi-stakeholder management mechanisms. This models' strength lies in maintaining ecological conservation rigor while reserving space for political dialogue.

In the long run, this balanced approach will yield multiple benefits. Ecologically, it could provide institutional safeguards for endangered species and vulnerable ecosystems. Economically, it could promote sustainable development of the blue economy through regulated development activities. Politically, it may help ease regional tensions and build a more constructive maritime order. Notably, this institutional design features adaptive characteristics that enable dynamic adjustments to evolving circumstances, thereby maintaining its effectiveness. Looking ahead, the successful implementation of this balanced approach will have far-reaching implications. It not only promises to improve the ecological environment of the South China Sea but could also serve as a model for governing disputed maritime zones. Through practical exploration, a marine conservation framework with distinct South China Sea characteristics may emerge, contributing Chinese wisdom to global ocean governance. While this process presents challenges, its ecological value and strategic significance warrant concerted efforts from all stakeholders to advance together.

Author contributions

YH: Validation, Writing – original draft, Writing – review & editing, Funding acquisition, Formal analysis. MY: Conceptualization, Writing – review & editing, Supervision, Methodology, Funding acquisition.

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Conflict of interest

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