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Rule of Law in the Progress of Sustainable Fishery Governance

Edited by
Yen-Chiang Chang

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Editor

Yen-Chiang Chang

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About the Editor

Yen-Chiang Chang

Professor Yen-Chiang Chang, LLM (National Taiwan Ocean University), Ph.D (University of Dundee, UK). After leaving the Taiwanese Coast Guard, having served as a legal enforcement officer, he accepted a research position at the Centre for Marine Policy Studies, Sun Yat-Sen University, Taiwan. Subsequently, having moved to the UK and whilst carrying out his Ph.D research, he was retained as a research assistant at the School of Law, University of Dundee. He has also had an internship with the British Institute of International and Comparative Law. In August 2007, he started to work for the Marine Institute, University of Plymouth, UK. His work involved a European project, which brought together a partnership of 27 investments, strategic public sector and research partners from Belgium, England, and France. His role was primarily concerned with promoting and facilitating sustainable port-based development and distribution, focusing on the economic, social, and environmental benefits. In 2009, he took up an Associate Professorship at Shanghai Maritime University. In 2010, he joined the School of Law, Shandong University, and was subsequently promoted as a Full Professor in 2011. In 2018, he started a new journey at the School of Law, Dalian Maritime University. According to Elsevier, Professor Chang was the most cited legal scholar in China between 2020 and 2022. His current research focuses on the legal governance framework regarding the exploration of marine renewable energy and the dispute settlement mechanism.

Preface

The future of the ocean depends on sustained and effective changes in the governance of natural resources. Over the last couple of decades, ocean governance has turned its focus to several key approaches, such as the creation and enforcement of protected marine areas and the implementation of sustainable fishery governance. The voluntary guidelines for securing fisheries, in the context of food security and poverty eradication, are the first international instruments entirely dedicated to the fishery sector. While its implementation will require legal and regulatory adjustments beyond national fishery legislation to ensure political and legislative coherence and to fully reflect the breadth of their provisions, the fundamental function of fishery law in the sustainable use, management, and development of small-scale fisheries is indisputable. Appropriate fishery legislation provides the strongest possible framework for inclusiveness, participatory fishery governance and resource management by providing a coherent basis for implementing and enforcing the related international and regional agreements and commitments. Legislation can therefore be a tangible way to support fishers, fish workers, and their communities and contribute to broader development goals, including the progressive realisation of the right to food, poverty eradication, equitable development, and sustainable resource utilisation as well as governance. This Special Issue aims to provide (social) scientists and legal experts with an opportunity to provide an overview of recent works carried out in the areas of fishery research and governance, coupled with the rule of law.

Yen-Chiang Chang
Editor

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Article

Conflicts and Challenges of Sustainable Fisheries Governance Cooperation under the Securitization of the Maritime Commons

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Abstract: There is a growing trend towards securitization of the maritime commons, which seriously impacts sustainable fisheries governance cooperation. This impact is mainly reflected in the fact that it undermines the effectiveness of the international legal framework for sustainable fisheries governance, which is fragmented and runs based on countries' willingness. It makes the international legal basis for sustainable fisheries governance cooperation more fragile. As a result, countries are more inclined to take the issues of sustainable fisheries governance and its sub-issues as security-related issues or tools for achieving maritime security strategies. Ultimately, it will lead to confrontation rather than cooperation in sustainable fisheries governance. Evidence that can support this theory is from combating IUU fishing, a sub-issue of sustainable fisheries governance, in the Northeast Asia Pacific and the South China Sea. From securitization theory and international law theory perspectives, desecuritization is the core of the solutions, including the desecuritization of the maritime commons and the desecuritization of its sub-issues. In practice, desecuritization includes improving the effectiveness of the international legal framework for sustainable fisheries governance and establishing regional cooperative governance mechanisms. The result will certainly help to promote sustainable fisheries governance cooperation on a regional and global scale.

Keywords: maritime commons; sustainable fishery governance; illegal, unreported and unregulated fishing (IUU Fishing); law of the sea

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1. Introduction

The principle of the freedom of the high seas profoundly influenced the exploitation of fisheries resources in the pre-industrial age [1]. Under the influence of this principle, the freedom of fishing on the high seas is enshrined as a customary law in the United Nations Convention on the Law of the Sea (UNCLOS), becoming one of the six freedoms enjoyed by any country on the high seas [2]. However, according to the data released by the Food and Agriculture Organization of the United Nations (FAO), global marine fisheries resources are declining. Global fish consumption increased at an average annual rate of 3.0% from 1961 to 2019 [3]; at the same time, the fraction of fishery stocks within biologically sustainable levels decreased to 64.6% in 2019, from 90% in 1974 [4], demonstrating a severe consequence of overfishing. Therefore, states began to pay attention to the sustainable use of fisheries resources, and the concept of "sustainable fisheries governance" was also introduced. The importance of sustainable fisheries governance has been recognized since the 1950s [5]. From 1970 to the present, marine life has declined by nearly 50%, implying an urgent need to achieve sustainable fisheries governance [6].

Sustainable fisheries governance is the sum of the legal, social, economic, and political arrangements used to achieve the goal of sustainable fisheries—involving habitat, ecosystems, etc. [7]—relating to the Sustainable Development Goals (SDGs) adopted by the United Nations (UN) [8]. Sustainable fishing guarantees the preservation of fisheries resources and the fish habitats in the future [9]. However, different from sustainable governance in

other fields, one of the characteristics of marine fish is that their movement is not restricted by artificially divided ocean areas, as is the case with migratory fish and transboundary fish [10]. Furthermore, any change in the ocean can cause a chain reaction: the extinction of one fish stock or a change in the environment of a sea area may affect the sustainability of other fish stocks or the environment of other sea areas; moreover, global issues such as climate change also have an impact on the maritime environment and the sustainability of fish stocks [11]. In other words, fish are uncontrollable, and ocean spaces cannot be separated. However, ocean governance under the law of the sea is based on the legal division of the ocean. According to UNCLOS, maritime areas are divided into five main zones—internal waters, territorial sea, the contiguous zone, exclusive economic zone (EEZ), and the high seas [2]. States have different powers and duties in different areas [2]. The difference between artificially divided oceans and natural oceans [1] implies that ocean governance, especially marine fisheries governance, requires cooperation among states because ocean governance is impossible to achieve by those measures that states take within their jurisdiction [12]—states' domestic laws can hardly be applied on the high seas. Therefore, in this field, sovereign states play the most critical role, which practice and achieve sustainable fisheries governance by developing fisheries legislation and policies to influence and regulate the behavior of other actors in fisheries, and international cooperation is necessary. The international legal framework for sustainable fisheries governance is constructed by setting forth rights and obligations for all states, through which the law of the sea provides a legal basis for cooperation among states in sustainable fisheries governance.

The law of the sea also limits, to some extent, the cooperation of states in sustainable fisheries governance. Under the influence of the freedom of fishing on the high seas [2], flag state jurisdiction [2], the principle of privity of treaty [13] as well as the rule of international law which proclaims that any state other than the flag state has no jurisdiction over foreign vessels on the high seas (established by the *Bering Sea (Fur Seals) Arbitration* [14]), sustainable fisheries governance, especially on the high seas, rely heavily on the willingness of states. The freedom of fishing on the high seas is still widely accepted and enforced, although it is gradually beginning to be restricted [15]; flag state jurisdiction and the rule of international law that vessels on the high seas have immunity from the jurisdiction of any states other than the flag state lead to a situation where, in the oceans where coastal states have no jurisdiction, only the flag state has jurisdiction over its vessels. In sustainable fisheries governance, it implies that on the high seas or in disputed waters, coastal states or flag states may refuse to regulate and punish those vessels breaking the rules of sustainable fisheries governance to practice their national security strategies. Moreover, the flags of convivence vessels, which is a common phenomenon, further produces difficulties for sustainable fisheries governance [16]. The flag that is flown by a convenience vessel is not the flag of the country of ownership, which results in the country of ownership having no jurisdiction over the vessel and the flag state being unwilling to regulate and punish the vessel.

Generally, the consideration of states' security plays an essential role in states' willingness and security strategies. When an issue is constructed as a security issue, namely, the issue is securitized [17], and its political sensitivity rapidly increases. In other words, the securitization of one issue will lead to a greater tendency of states to confront rather than cooperate on this issue and other sub-issues associated with it [18]. The securitization of maritime commons and its impact are gaining increasing discussion in the maritime field [19], which can lead to the maritime commons and those issues occurring within it becoming security issues. Securitization can also reduce a state's willingness to cooperate [20]. However, sustainable fisheries management and governance need international cooperation, which relies on the willingness of all states. Therefore, it is necessary to find solutions based on international law, which is an effective basis for cooperation.

From the perspective of international law and securitizations theory, this article focuses on the conflicts and challenges faced by international cooperation in sustainable fisheries governance due to the securitizations of maritime commons. This article first anal-

yses securitization theory and discusses the international legal framework for sustainable fisheries governance, which is a legal basis for international cooperation in this field. This article finds that the securitization of the maritime commons has damaged the international legal framework for sustainable fisheries governance, leading to the destruction of the foundation of international cooperation and the securitization of sub-issues in this field. Illegal, unreported, and unregulated (IUU) fishing has become a sub-issue that is heavily affected by the securitization of the maritime commons [21]. Therefore, after analyzing the international legal framework for addressing IUU fishing, the second part of this article chooses evidence from the Northeast Asia Pacific and the South China Sea to demonstrate that the securitization of the maritime commons has undermined international cooperation to combat IUU fishing by damaging the legal basis of international cooperation and securitizing IUU fishing. This epitomizes the detriment of the securitization of the maritime commons to international cooperation on sustainable fisheries governance. Subsequently, desecuritization is considered the core of the solution to the negative consequences produced by the securitization of the maritime commons. By desecuritization, security issues and non-security issues in the maritime commons can be distinguished and addressed separately. The political sensitivity of sustainable fisheries governance, incorporated into non-security issues, is reduced, which can effectively promote cooperation among states in this field. A formal conclusion follows the discussion of the role that international law and regional cooperation mechanisms can play in desecuritization and sustainable fisheries governance.

2. The Impact of the Securitization of the Maritime Commons on the International Sustainable Fisheries Governance Cooperation

2.1. The Securitization of the Maritime Commons

The definition of the maritime commons is the premise of discussing its securitization of the maritime commons. The concept of "commons" refers to those "areas of the world beyond the control of any one state" [22]. Oceans, outer space, and cyberspace are considered as typical commons [23]. However, different from the other two commons, there is a relatively complete international law in maritime commons [24], which is the international legal basis for states to govern the ocean. UNCLOS divides the ocean into different zones, where states have different rights and obligations [2]. It implies that the entire ocean cannot be called maritime commons, only the high seas, which are beyond the control of any state. In addition, in disputed waters due to maritime boundary disputes [25], there may be two or more states claiming sovereignty over a specific disputed water, but none of these states can control the disputed maritime area. This results in the disputed waters not being under the complete control of any state; therefore, these waters are also considered as a kind of maritime commons.

The basic concept of securitization theory is "security". Traditional international relation theory equates security with military security [26], relating to the use of force to defend national interests with high political sensitivity [27]. However, in proposing securitization theory, the Copenhagen School expanded the scope of security and included threats beyond those of the military [28]. According to the definition of securitization, security is a kind of existential threat considered urgent and important [17]. In addition, securitization theory is an extension of traditional security theory. Hence, the security referred to by securitization theory should also have the same characteristics as traditional security. Therefore, security, the basis of securitization theory, refers to those urgent and important existential threats relevant to those national interests with high political sensitivity. As such, the primary approach of securitization is constructing a non-traditional security issue as a danger, emergency, and imminent threat with high political sensitivity [27]. There are three elements of securitization: a securitizing actor who can declare a threat and initiate the securitization process, a referent object which can be identified and produce a potential threat, as well as a complete securitization process where the audiences need to be persuaded and accept the issue as a security threat [29]. Securitization theory assumes that an issue is securitized

when it poses or is considered a threat, which also means the vital interests or powers are damaged or considered to be damaged [30]. When a securitizing actor believes the damage has or will happen, they tend to initiate the securitization process in which the referent object is securitized, thus, changing a non-security issue into a security issue. The securitization process includes two parts: securitizing moves and security practices [31]. The securitizing move is the action of constructing securitization: the securitizing actor associates an issue with security through legislation, policies, and other means. Further, when the security issue is accepted by the audience and seen as an existential threat, the issue is securitized and becomes a security issue. Security practice refers to those actions taken by a security actor after an issue has been successfully securitized. After the two actions are carried out, the whole process of securitization is completed, which changes non-security issues with low political sensitivity into security issues with high political sensitivity, and leads states to take confrontational measures [18]. Although securitization theory faces many criticisms [32,33], securitization, especially that of maritime, climate change, cyberspace, and other commons, is still generally considered to be real and to have widespread implications [19,22,34–36]. Therefore, this article chooses the generally accepted securitization framework to determine the reasons and the process for the securitization of the maritime commons.

The securitization of the maritime commons will be examined in the same way as above. The first item to consider is the concept of "maritime security". The traditional concept of maritime security is associated with the military [37]. However, with development over time, the concept of "maritime security" is constantly expanding and becoming vague [38], with some non-traditional maritime security issues regarded as maritime security issues, such as IUU fishing, piracy [39], terrorism [40], etc. [41]. The maritime commons can more likely be considered relevant to security, and issues occurring within them are more likely to be constructed as security issues, such as fishing in the South China Sea [42]. The reasons for the securitization of the maritime commons are various. In different maritime commons, maritime transport, marine resources, history, refugee [43] smuggling by sea [44], and other factors can be reasons for the securitization of the maritime commons [45]. Those reasons can be divided into two parts. The first driving force to promote the securitization of the maritime commons derives from the desire of states to ensure national maritime security, which can safeguard their interests [45], with globalization strengthening this desire [46]. Evidence from the Gulf of Aden [47], the South China Sea [48], and other waters support this opinion. The second driving force derives from the desire of states to practice national security strategies by securitizing the maritime commons. The United States (US) maritime security strategy is a typical example of this purpose [42]. Incorporating how to use the commons and maintaining access to the commons into the political agenda is considered a central part of the US global security strategy and of maintaining power and influence [22,34]. In the securitization process of the maritime commons, the securitizing actors are sovereign states. The referent objects are the maritime commons and sub-issues occurring within them, such as IUU fishing, resource extraction, etc. The securitization process is initiated when those objects lead to or are considered to lead to potential threats. In the process, states link the maritime commons and those sub-issues with national security through documents such as national security strategies. When the audience accepts that the maritime commons can cause an existential threat, the maritime commons is securitized. However, different from the securitization of the specific issues, the securitization of the maritime commons is more macroscopic, which is called macrosecuritization [49], and includes more stakeholders and a more complex process of securitization and sub-issues affected by the securitization of the maritime commons or sub-issues that are also securitized [46]. Further, those securitized sub-issues may ultimately drive the securitization of the maritime commons. In other words, securitization includes that at the strategical level and at the tactical level, namely, the securitization of the maritime commons due to the existence of potential conflicts within them, and the securitization of the specific sub-issues [50]. The latter will likely further promote the

securitization of the maritime commons. A typical case is from the South China Sea, where fisheries are linked to national sovereignty and territorial integrity, which leads to their securitization [50], resulting in coastal states tending to deploy more naval and coast guard assets [51] and risking the use of force more frequently [52]. The securitization of fisheries in the South China Sea, therefore, becomes a motivation to securitize this water [50,53].

2.2. The Basis of International Sustainable Fisheries Governance Cooperation: International Legal Framework for Sustainable Fisheries Governance

International legal fishery management instruments regulating ocean-related activities require countries to practice sustainable fisheries governance by regulating their actions, including UNCLOS; the Code of Conduct for Responsible Fisheries; the Cancun Declaration; the Rio Declaration; Agenda 21; a series of resolutions and decisions on sustainable fisheries adopted by the UN General Assembly; a series of conventions on the establishment of regional fisheries management organizations (RFMOs), such as the Convention for the Establishment of an Inter-American Tropical Tuna Commission; as well as conventions related to animal protection, such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora. Compared with other non-legally binding international guidance documents or declaration documents, UNCLOS, which has a legally binding and dispute settlement enforcement mechanism, is the most important of those international legal instruments. UNCLOS sets forth the rights and obligations of states regarding conserving marine life and protecting the marine environment [2], which is the international legal basis for achieving sustainable fisheries and marine ecosystem governance. It promotes action on sustainable fisheries governance by requiring obligations on states for sustainable governance. In Part V and Part VII, UNCLOS provides specific regulations for states to practice sustainable fishery governance in the EEZ and the areas of the high seas. For example, Part V sets forth the obligations of coastal states to conserve and manage marine living resources, and Part VII sets forth that states have the obligation to conserve and manage living resources on the high seas [2]. In addition, Article 118 of UNCLOS requires that, in the conservation and management of living resources on the high seas, states shall "as appropriate, cooperation to establish" subregional or regional fisheries management organizations [2]. Article 118 is the legal basis for international cooperation among states in sustainable fisheries governance. States cooperate and enter into bilateral or multilateral agreements for cooperation under Article 118. However, due to being too broad, this provision is unlikely to be enforced, and disputes arising from actions violating Article 118 are difficult to resolve through the dispute settlement mechanism provided by UNCLOS. Therefore, the implementation of Article 118 in practice remains heavily dependent on the willingness of states.

International treaties that regulate specific sustainable fisheries governance issues fall into two categories. One category is international treaties relating to the conservation and management of specific fish stocks. Such treaties account for the vast majority of international treaties concerning sustainable fisheries governance, such as the Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea [54], the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean [55], etc. However, such conventions are designed for specific fish stocks that are harmed by fishing activities, and their coverage is usually limited to specific sea areas. The second category is international legal instruments regulating specific marine fisheries activities, such as the series of international treaties developed to combat IUU fishing, as well as the standards and restrictions to achieve responsible fishing practices, which cover aspects such as fishing gear, banning some fishing methods, capture quantities, etc. The number of such international legal instruments is relatively few. However, the treaties on combating IUU fishing comprise the majority of them, as IUU fishing has gained increasing attention due to the damage it causes to the sustainability of fisheries [56], and its influence on human rights abuse or trafficking. Combating IUU fishing is an essential issue in international sustainable fisheries governance cooperation, which is considered

relevant to the country's economy and food security [57]. The interest in the issue has led to a rapid increase in the number of international treaties on combating IUU fishing in the last decade [58], which creates a relatively complete legal framework in specific areas of sustainable fisheries governance.

The above analysis suggests problems with the international legal framework for sustainable fisheries. Firstly, global treaties directly regulating sustainable fisheries governance are largely absent in the legal framework. The international legal document directly related to sustainable fish governance is the Code of Conduct for Responsible Fisheries [59]; however, as a guidance manual, it is not legally binding. At the same time, although UNCLOS is legally binding, it does not directly involve the content of sustainable fishery governance, but only sets forth the rights and obligations of the state in marine environmental protection, the conservation and management of marine resources, as well as cooperation. Further, it only enables UNCLOS to promote national cooperation on some issues in sustainable fisheries governance, and acting on the rule of cooperation heavily relies on states' willingness. Secondly, international treaties related to the conservation and management of specific fish stocks occupy the vast majority of the legal framework, but these issues are only a small part of sustainable fisheries governance. Moreover, the number of international treaties directly regulating marine fisheries is relatively few, and there is only a moderately complete legal framework in a special area, such as the conservation of some specific fish stocks. This suggests that an uneven coverage of issues characterizes the international legal framework for sustainable fisheries governance: for some issues, international legal provisions are complete, but for others, they are absent. This unbalanced legal framework leads states to spend more resources to fill legal gaps in the practice and cooperation of sustainable fisheries governance; however, the rising cost of practice and cooperation can undermine states' initiative and willingness. Finally, the provisions of UNCLOS relating to sustainable fisheries governance, which has a legally binding and effective dispute settlement mechanism, are challenging to implement effectively because UNCLOS lacks specific provisions on sustainable fisheries governance. However, other international legal instruments, which directly relate to sustainable fishing governance and have specific provisions, face other difficulties: few contracting parties, narrow scope of application, and a lack of effective dispute settlement mechanism. The two factors have resulted in the implementation of sustainable fisheries governance and international cooperation being heavily dependent on the willingness of all states. In sum, the international legal framework for sustainable fisheries governance is characterized by uneven coverage of issues, a lack of legally binding international instruments, and an absence of enforcement mechanisms, resulting in a weak international legal basis for cooperation. Thus, the willingness of states has a significant impact on the practice and cooperation of sustainable fisheries governance.

2.3. The Impact of the Securitization of the Maritime Commons on the International Cooperation in Sustainable Fisheries Governance

The characteristics of the international legal framework for sustainable fisheries governance implies that in this field, states' willingness has a decisive influence on whether international cooperation can occur. The securitization of the maritime commons changes the priorities of countries' maritime activities and reduces states' willingness to cooperate, which can damage international cooperation in sustainable fisheries governance. The securitization as a result of climate change and its subsequent practices have proved, that while securitization focuses the attention of states on a particular area, it also has an obvious negative impact on governance and international cooperation in this field [36]. In sustainable fisheries governance, the rules can also be applied. The securitization of the maritime commons has increased states' attention to the maritime commons and various sub-issues occurring within them. It has also made it easier for states to prioritize national security when making decisions. Hence, states will be more inclined to confront rather than cooperate in maritime commons to safeguard their security interests [18]. In addition,

the securitization of the maritime commons promotes the securitization of fisheries. Fisheries issues are a sub-issue within the maritime commons and are generally considered low-political issues. Hence, states tend to cooperate on these issues to enhance strategic trust, which is the basis for countries to cooperate on high political issues [50]. However, the securitization of the maritime commons has interfered with this route, leading to issues associated more easily with those that are highly political, and resulting in these issues being securitized. The securitized fisheries issue in the South China Sea region provides valid evidence of this [42,45,50,60].

From an international law perspective, in sustainable fisheries governance, another impact is the lack of practice experience due to the reduction in states' willingness to cooperate, resulting in the absence of international legal instruments, an incomplete international legal framework, as well as difficulty establishing RFMOs and international sustainable fisheries governance mechanisms. The two important reasons for the above consequences are the inefficiency of enforcement mechanisms in the international legal framework and the fact that the framework focuses too much on states and ignores other actors in this field, for example, most international legal instruments lack focus on RFMOs. It also implies that it is possible to reduce the damage caused by the securitization of the maritime commons to sustainable fisheries governance by improving the international legal framework for sustainable fisheries governance. In other issues of the maritime commons, there are already examples of reducing the negative impact of the securitization of the maritime commons by enhancing the effectiveness of international legal documents and increasing their attention to other actors in the international community, such as the cooperation mechanism to combat piracy in the Gulf of Aden [47], the EU cooperation mechanism to combat IUU fishing [61], etc. To find suitable solutions to improve the international legal framework, it is also necessary to examine cases from a specific field of sustainable fisheries governance.

3. Evidence from Combating IUU Fishing in the Pacific

3.1. International Legal Framework for Combating IUU Fishing

In sustainable fisheries governance, combating IUU fishing has a relatively complete international legal framework. The Pacific is one of the seas where IUU fishing occurs most frequently [62], and it is also the maritime commons most affected by securitization [50,63–65]. Therefore, this section uses evidence from the Pacific to illustrate the impact of the securitization of the maritime commons on cooperation in combating IUU fishing.

It is necessary to clarify the international legal framework for combating IUU fishing as the basis for international cooperation in this field before analyzing how the securitization of the Pacific has impacted on international cooperation to combat IUU fishing. The international legal instruments to combat IUU fishing include UNCLOS; the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas (1993 Agreement); the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (1995 Agreement); the International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (IPOA-IUU); the Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (PSMA); and the Request for an Advisory Opinion submitted by the Sub-Regional Fisheries Commission (Advisory Opinion). Although the term "IUU fishing" does not appear in UNCLOS, the 1993 Agreement, or the 1995 Agreement [66], it does not affect the importance of these three legal instruments in the international legal framework for combating IUU fishing. In addition, there are provisions related to combating IUU fishing in World Trade Organization law, international labor law, and international environmental law. However, this article does not include them in the international legal framework for combating IUU fishing because these international legal instruments are usually not directly related to the issue.

The law of the sea achieves sustainable fisheries governance by regulating states. The same approach is followed by the international legal framework for combating IUU fishing. The international legal framework sets forth rights and obligations for coastal states, flag states, and port states. The coastal state is one of the first legal subjects to be included in this legal framework. UNCLOS sets forth a general obligation for states to protect and preserve the maritime environment. The general obligation is interpreted as an obligation with customary character to conserve marine living resources [67] and a duty to cooperate in this field [2,67,68]. This conservation obligation is implemented through the 1995 Agreement [69] and those conventions about the conservation and management of specific fish stocks. At the same time, this obligation implies that coastal states shall take measures to combat those activities which will damage the marine environment and marine living resources, including IUU fishing. Article 73 of UNCLOS provides solutions for coastal states to combat IUU fishing, including boarding, inspection, arrest, and judicial proceedings [2,70]. However, because neither UNCLOS nor the 1995 Agreement mentions IUU fishing directly, the EU experiences show that the role of coastal states in combating IUU fishing is often overlooked or confused with flag states or port states [71]. It also undermines the clarity of the legal framework of international law for combating IUU fishing.

Flag state jurisdiction under UNCLOS is the international legal basis for flag states to play a central role in the framework for combating IUU fishing. Vessels are the main actors in carrying out activities in the sea. As a general rule, the flag state is the only state with jurisdiction over ships in the maritime commons [2,14]. The 1993 Agreement sets forth an obligation for flag states to ensure those ships flying their flags comply with international conservation and management measures on the high seas [72]. In combating IUU fishing, this regulation also suggests that flag states have power to take action against vessels that fly their flag and undertake IUU fishing. In addition to those available to coastal states, solutions available to flag states to combat IUU fishing include refusal, suspension, or withdrawal of the authorization to fish on the high seas, as well as other punishment, which is effective in "securing compliance with the requirements of" the 1993 Agreement and "to deprive offenders of the benefits accruing from their illegal activities" [72]. Then, *the Advisory Opinion* sets forth the obligation of flag states to combat IUU fishing [73]. It complements the absence of IUU fishing in UNCLOS and the 1993 Agreement [66]. The *Advisory Opinion* divides the obligations of flag states into the general obligation under UNCLOS and the specific obligation centered on the obligation of due diligence. The latter allows for a coastal state to require that the flag state whose vessels conduct IUU fishing in its EEZ shall be liable for failure to take sufficient necessary and appropriate measures to fulfill the obligation of due diligence [73]. The *Advisory Opinion* sets forth the obligation of flag states in combating IUU fishing and urges that flag states shall take sufficient necessary and appropriate measures to prevent those vessels flying their flags from conducting IUU fishing. In addition, the IPOA-IUU adopted by FOA in 2001 also focuses on flag states. The IPOA-IUU, based on defining IUU fishing, requires states worldwide to take measures to combat IUU fishing [74]. The IPOA-IUU sets forth the responsibilities of the flag state in this process. Moreover, the IPOA-IUU requires states to ensure that nationals under their jurisdiction do not support or participate in IUU fishing. To this end, the IPOA-IUU requires states to cooperate to identify, prosecute, and sanction those groups of people involved in IUU fishing [75]. However, as a voluntary instrument [74], the IPOA-IUU is challenging to achieve the expected effect in practice, although it provides a comprehensive toolbox to combat IUU fishing.

Having identified the limitations of coastal states and flag states in combating IUU fishing, international legal instruments to combat IUU fishing have begun to require port states to take measures to combat IUU fishing. The approach of port state governance is to focus on the role of the market for IUU fishing [76] based on considering IUU fishing as a transnational crime [77]. Following this approach, as a port of entry into a country's market, port states are seen as effective tools that can combat IUU fishing by preventing fish caught by IUU fishing from entering the market, which can reduce the economic incentive

for IUU fishing [58]. The IPOA-IUU is the first international document that focuses on the role of port states in combating IUU fishing [75]. The IPOA-IUU requires port states to take measures, including prohibiting IUU fishing vessels from entering the port, the review of the catch entering the port, etc. According to the regulation of the IPOA-IUU, the PSMA was adopted and came into force in 2016. The PSMA sets forth that the port states shall take measures to combat IUU fishing through ports, entry inspections, and follow-up procedures [78]. Regarding international cooperation, the PSMA stated that flag states and port states shall cooperate in combating IUU fishing [78]. It is the first time that this obligation has been established as an international legal document. However, there are still few parties to the PSMA [79], which limits the effectiveness of its implementation.

This legal framework has the same shortcomings: the principle of privity of treaty limits the role of international treaties. In combatting IUU fishing, some fishing activities are beyond the jurisdiction of states and international treaties [80]; for example, vessels flying the flags of non-party states do not consider themselves bound by the relevant international legal instruments, e.g., of RFMOs. Moreover, the international legal framework for combating IUU fishing is enforced by setting forth powers and obligations of coastal states, flag states, and port states. It suggests that this international legal framework for combating IUU fishing faces the same problems as the international legal framework for sustainable fisheries governance: the willingness of states can seriously affect their actions towards combating IUU fishing and their cooperation on this issue. Therefore, researchers believe that those legal instruments on fishing have not ended IUU fishing but have increased tensions between states and contributed to the securitization of IUU fishing [42].

Another problem to be addressed by the international legal framework for combating IUU fishing arises from the characteristics of IUU fishing itself. Usually, both the subject and operation of IUU fishing are transnational, implying that a state may simultaneously be a victim and a "perpetrator" of IUU fishing [81]. This renders a domestic solution to combating IUU fishing unlikely to be effective. In other words, it implies that a global or regional solution to combating IUU fishing is necessary, such as international legal instruments that relate to combating it. Given that IUU fishing may be a transnational organized crime [81], it is inconceivable that a single state alone can effectively combat IUU fishing. However, although the international legal instruments used to combat IUU fishing provide a complete framework, they have apparent shortcomings in quantity and effectiveness [81]. In this framework, the PSMA is the first and only legally binding international treaty that directly regulate IUU fishing, but it still faces a shortage of parties. However, UNCLOS, which has the most influence and many parties, does not directly regulate IUU fishing. Moreover, international legal documents about combating IUU fishing are mostly soft laws and lack mandatory provisions [66]. In addition, even taking these soft-law documents and legal documents indirectly regulating the fight against IUU fishing into account, there is still a shortage of international legal documents about combating IUU fishing. In terms of content, the legal framework provides a guidance program with few specific sanctions or solutions. The framework is also too simplistic in its provisions for cooperation between states in combating IUU fishing, which lacks enforceable rules and the focus on regional and global organizations that are effective cooperation models.

The above analysis suggests that this legal framework, although relatively complete, is still fragile. The characteristics of this framework render it unable to deal with the impact of the securitization of the maritime commons. The state-centered legal framework and the lack of attention to regional and global organizations means that the willingness of states remains decisive for action and cooperation in combating IUU fishing. When a state's willingness to cooperate declines, the legal framework cannot take measures to deal with it. The lack of enforceable rules makes it more difficult for countries to cooperate, thereby increasing the cost of cooperation. Moreover, the limited number and effectiveness of those international legal instruments prevent them from taking more effective measures to avoid contradictions and disputes when states refuse to cooperate because of the securitization of the maritime commons. The consequence of the failure of the legal framework to eliminate

the negative impact of the securitization of the maritime commons is either that combating IUU fishing becomes a tool for states to achieve their maritime security strategies or that the issue of IUU fishing itself is securitized. In either case, the result leads to less and more fragile international cooperation, ultimately undermining international cooperation on sustainable fisheries governance.

3.2. Evidence from Northeast Asia Pacific and South China Sea

When competition in the Pacific was less intense, coastal states achieved cooperation on some low-political issues through various bilateral and multilateral agreements; for example, those states with maritime boundary disputes still signed a series of fishery agreements, a such as China and Vietnam [38,82]. However, as tensions in the Pacific grew [83], the Pacific began to be securitized. These tensions were related to changes in the maritime security policies of major powers, especially the US. An important assumption of the US national security strategies is that the US has uncontested leadership of the global commons [22]. Further, leadership in the Pacific is of most concern to the US because it is seen as the most important region for the country's future [84]. However, the rise of other states in the Pacific, e.g., China, and their involvement in maritime affairs, have led the US to worry about the erosion of that assumption. This concern has ultimately motivated the US to securitize the maritime commons, especially the Pacific [84,85]. The change in US maritime security policy has impacted the securitization of the Pacific region. US–Asia policy has undergone a process from securitization to desecuritization to resecuritization [86], which has certainly affected the national security of those coastal states and the degree of the securitization of the Pacific [87–89]. The securitization of the maritime common in the Northeast Asia Pacific [65] and the South China Sea [45,90] are most significant, and their impact on regional cooperation is the most obvious.

3.2.1. Combating IUU Fishing in the Northeast Asia Pacific

Apart from the reasons discussed above, the securitization of the Northeast Asia Pacific is related to the securitization of energy supply in the region, as well as to the region's history, military security, geography, and other factors [65]. Moreover, the increased economic interdependence in this region has not slowed the trend toward the securitization of the maritime commons in the area [65]. The three major countries in the region have different motivations for securitizing the waters. China's motivation is increasing attention to the role of the ocean in national development and its influence in the maritime realm [91]. Japan regards maritime order as the foundation of the country's peace and prosperity and safeguarding its interests in the maritime commons as one of the core preconditions of its national security strategy [64], which are the driving forces for Japan to participate in the securitization of the Northeast Asia Pacific. The dependence of economic development on maritime transportation and marine resources [92] is the main driving force of South Korea's increasing focus on maritime security and maritime military power [93], which has also affected its maritime security strategy. In addition, the maritime territorial disputes between China, Japan, and South Korea have certainly accelerated the competition for the securitization of the Northeast Asia Pacific [65], which also affect cooperation between the parties on sustainable fisheries governance and combating IUU fishing.

The fishery issue is one of the critical issues in the maritime boundary delimitation between China, Japan, and South Korea. China–Japan fishery cooperation and China–Korea fishery cooperation reflect the impact of the securitization of the Northeast Asia Pacific on combating IUU fishing cooperation in the region. The cooperation between China and Japan in combating IUU fishing has been directly influenced by the relationship between the two countries and by the securitization of the Northeast Asia Pacific. China and Japan signed the Agreement on Fisheries Concluded Between Japan and China (1995 Agreement on Fisheries) in 1995, which provided the basis for cooperation between the two countries in fisheries. However, the disputed waters between the two countries were avoided in the 1995 Agreement on Fisheries, laying a hidden danger for their subsequent cooperation in

fisheries: the cooperation between the two countries in fisheries is more likely to be affected by the securitization of the maritime commons. The lack of substantive progress in fishery development cooperation in the East China Sea in 2014–2015, caused by Japan's purchase of the Diaoyu Islands in 2012, is evidence of this [94]. In addition, as relations between the two countries have deteriorated and their attention to maritime security has increased, the conflict and dispute regarding fisheries have also increased. In the process, combating IUU fishing has become a tool for countries to achieve national security strategies. For example, the government of Japan has repeatedly claimed that the fishing by Chinese vessels near the Diaoyu Islands is IUU fishing. The same situation also happened between South Korea and China. In 2000, China and South Korea signed the Fisheries Agreement between South Korea and China (2000 Fisheries Agreement), in which provisional arrangements were made on fisheries issues between the two countries. According to the 2000 Fisheries Agreement, the two countries shall hold consultations on several issues on fisheries by convening the China–South Korea Joint Fishery Committee every year. The joint law-enforcement issue discussed on the committee is related to cooperation and combating IUU fishing. Compared to the 1995 Agreement on Fisheries, the 2000 Fisheries Agreement has performed better [95]. However, regarding fishery law enforcement, with the deployment of the Terminal High Altitude Area Defense and changes in maritime security policies in South Korea, the two countries have paid more attention to maritime security, resulting in conflicts that have gradually surpassed cooperation. For example, South Korea's coast guard arrests and detains Chinese fishing boats more frequently [96] and has continued to increase the severity of law enforcement and penalties [97]. However, most of the arrested and detained Chinese vessels do not violate fishery regulations or engage in IUU fishing [96].

3.2.2. Combating IUU Fishing in the South China Sea

Compared to the securitization of the Northeast Asia Pacific, the securitization of the South China Sea and its impact on combating IUU fishing are more complex. The disputes caused by climate change, geopolitics, institution, history, and other factors in the South China Sea mean that it has a strong tendency to be securitized [5,98]. These factors provide the coastal states a strong incentive to initiate the securitization of the South China Sea [48]. Countries outside the region have also influenced the securitization of the South China Sea. The strengthening of the strategic competition between China and Japan in the Northeast Asia Pacific [42] and the importance of the maritime routes are essential motivations for Japan [64] to intervene in the South China Sea. Japan has enhanced its influence in the South China Sea and Southeast Asia by exporting military technology and hardware to southeast Asian states [99], adjusting its maritime military arrangement to strengthen its military participation in the South China Sea [100], and other approaches, which increase the tendency of the coastal states to securitize the South China Sea. An essential consequence of the securitization of the South China Sea is that IUU fishing, which was initially one of the marine issues, also faces the risk of being securitized in this region. The securitization of IUU fishing in the South China Sea is an issue that has emerged and persisted [42,50]. It is generally believed that territorial sovereignty disputes between coastal states [101]; the relationship between IUU fishing and the security of national maritime boundaries [37]; the popular narrative of the fishing militia [50]; and the lack of RFMOs in the South China Sea [101] are the main obstacles to combating IUU fishing in the region [102], which become motivations to securitize IUU fishing in the region after the securitization process.

The negative impact of the securitization of the maritime commons on combating IUU fishing is directly reflected in the lack of mechanisms and treaties for cooperation in fisheries governance in the South China Sea. The South China Sea lacks effective multilateral governance agreements or governance institutions. This means that cooperation in combating IUU fishing lacks existing mechanisms as a basis, and the cost of establishing a new cooperation mechanism is certainly higher. Moreover, the securitization of the South

China Sea reduces trust among states, as well as the opportunities for them to build trust; this strategic trust is the basis for states to cooperate. The maritime security complex formed by the coastal states in the South China Sea is a large and diverse security complex with different and conflicting perspectives in different aspects, such as problem solving and work focus [103]. Therefore, compared with other places, the coastal states in the South China Sea need a higher level of trust to cooperate on a certain issue; moreover, the securitization of the maritime commons will damage the trust among these coastal states, making it more difficult for them to conclude multilateral governance agreements or establish multilateral cooperation mechanisms to combat IUU fishing. The securitization of the maritime commons strengthens the lack of public goods and regional laws for combating IUU fishing and increases the cost of cooperation in the South China Sea. As the implementation of the international legal framework for combating IUU fishing is heavily constrained by the willingness of states, flag state measures [101] that are believed to be effective in combating IUU fishing cannot be effective in the South China Sea when the motivation, willingness, regional legal instruments, and RFMOs to cooperate in combating IUU fishing are insufficient.

In addition, there are few bilateral agreements on cooperation in combating IUU fishing in the South China Sea; for example, China is implementing several substantial approaches to combat IUU fishing [104]. However, in waters where cooperation in combating IUU fishing is required, China will combat IUU fishing through bilateral arrangements or legal documents [38]. Joint maritime law enforcement between China and Vietnam and the two related agreements are suitable arrangements for cooperation in combating IUU fishing [101]. However, among those coastal states in the South China Sea, the Sino-Vietnamese Fishery Agreement in the Gulf of Tonkin is the only bilateral fishery agreement in force [38]. This has led to a lack of support from sufficient international legal instruments for cooperation in combating IUU fishing in the South China Sea. More importantly, in the absence of a sufficient number of treaties on cooperation in combating IUU fishing, it is impossible to sign multilateral treaties or establish cooperation mechanisms in the South China Sea to ensure this cooperation. This is because it suggests that the region lacks sufficient willingness to cooperate, in terms of practical experience, customs, legal documents, etc.

3.3. How the Securitization of the Pacific Impacts International Cooperation in Combating IUU Fishing

The negative impact of the securitization of the Pacific is achieved by affecting the willingness of states to take measures and cooperate in combating IUU fishing. As evidenced by the Northeast Asia Pacific and the South China Sea, states are more inclined to view IUU fishing as a tool to achieve national maritime security strategies rather than a problem that needs to be solved cooperatively under the influence of the securitization of the maritime commons [96]. The evidence from the South China Sea supports that the securitization of the region and the resulting securitization of IUU fishing in this water has led states to pay more attention to maritime disputes rather than maritime cooperation, and to the reduction in trust and cooperation on combating IUU fishing, although IUU fishing is the main reason for the reduction in fishery resources and the degradation of the environment in these waters [90], which requires cooperation to solve. This has resulted in the absence of legal instruments and practices of cooperation in combating IUU fishing. In turn, this absence has hindered the construction of effective multilateral treaties or cooperation mechanisms in this region on cooperation in combating IUU fishing, ultimately making it more difficult for coastal states to cooperate in this field.

Moreover, the securitization of the Pacific makes it easier for all issues in the Pacific to be linked to highly political issues, and thus, to be securitized. The securitization of IUU fishing is one of the consequences of the securitization of the Pacific [42]. In the Pacific, the direct motivation to securitize IUU fishing is concern about the decline of fisheries resources, with IUU fishing being one of the main reasons [3]. Therefore, IUU fishing is

considered to pose a threat to food and economic security; some states believe that it may constitute a transnational organized crime and have included it in their maritime security strategies [37,105]. This brings IUU fishing into the scope of maritime security [40]. As a result, after the maritime commons are securitized, IUU fishing will be more likely to be securitized than other issues that also occur in the maritime commons. According to the evidence from the Northeast Asia Pacific and the South China Sea, the negative impact of the securitization of the maritime commons on combating IUU fishing is significant. For example, after the securitization of fisheries and IUU fishing in the South China Sea, most maritime disputes involved fishing vessels, which were often accused of engaging in IUU fishing [50]. This increase in disputes and conflict can lead to reduced trust among states. One consequence of the reduction is that it becomes difficult for states in the South China Sea to sign cooperation agreements and establish regional cooperation mechanisms for combating IUU fishing. At the same time, the South China Sea faces a lack of institutions for cooperation in combating IUU fishing. The securitization of the South China Sea will cause this issue to become a highly politicized issue, and the willingness of states to develop agreements or establish cooperative mechanisms will likely be further reduced. These impacts will ultimately be reflected in the absence of bilateral or multilateral treaties and the lack of regional cooperation mechanisms in the South China Sea.

4. Returning to the Essence of Sustainable Fisheries Governance: Solutions to the Securitization of the Maritime Commons

4.1. The Core of the Solution: Desecuritization of the Maritime Commons and Sustainable Fisheries Governance

Security theory believes that the desecuritization or desecuritization of some issues in the maritime commons can effectively solve problems posed by the securitization of the maritime commons [106]. The methods of desecuritization usually include: not treating it as a security emergency, not creating security dilemmas and vicious circles, as well as returning the securitized issued to low political issues [107]. In the securitization of the maritime commons, desecuritization includes the desecuritization of the maritime commons and the desecuritization of the sustainable fisheries governance. One of the goals of the securitization of the maritime commons is to protect states' maritime security. However, the evidence from the Gulf of Aden shows that the securitizations of the maritime commons cannot ensure maritime security [47]. Conversely, securitization leads to less cooperation because it reduces the level of trust among states, reducing their ability to respond to common risks at sea, such as the reduction in fisheries resources, environmental pollution, piracy, etc. It also implies that the desecuritization of the maritime commons is necessary; however, the feasibility of this is very low. Therefore, in practice, the desecuritization of the maritime commons faces a dilemma: desecuritization is necessary, while states usually refuse it. The Arctic Council is a typical example. The Arctic Council, whose purpose is not related to military security, became involved in issues related to military security, and soft tissues in the Arctic began to be securitized [108], such as the securitization of climate change in the Arctic [27]. Despite facing much criticism, the Arctic Council and its member states maintain their focus on military issues. The same thing also occurs in the maritime commons. Once the securitization of the maritime commons begins, although desecuritization is the best option for all states, the prisoner's dilemma prompts states choose to continue to treat the issues of the maritime commons as security issues and to reject desecuritization in situations when it is impossible for states to decide whether other states are genuinely fulfilling their commitment to desecuritization [102–104]. The trend towards the securitization of the maritime commons is set to continue in light of the maritime policies currently adopted by states. However, it does not mean that decoupling between sustainable fisheries governance and security issues is also infeasible.

In the context of the continuing trend of securitization of the maritime commons, decoupling the sustainable fisheries governance from security issues is an alternative solution in order to achieve sustainable fisheries governance cooperation. Traditionally, fisheries governance is considered a low-level political issue compared to the military;

states usually build and promote trust by cooperating on low-level political issues [50]. It is necessary to return sustainable fisheries governance to a low political nature, which can promote trust and cooperation among states on this issue. According to the practice of the Arctic Council [108], international legal instruments can achieve this by distinguishing sustainable fisheries governance from security issues. In addition, the critical difficulty in achieving cooperation on sustainable fisheries governance is the regulation of private actors [71]. This requires cooperative governance, which also requires states to take domestic and international measures. International law is an effective approach to regulate the behaviors of states, achieve international cooperation, and establish cooperative governance mechanisms. Therefore, the goal can be achieved by improving the international legal framework for sustainable fisheries governance and establishing regional cooperative governance mechanisms.

4.2. Improvement of International Legal Framework for Sustainable Fisheries Governance

The law of the sea is certainly necessary for achieving sustainable fisheries governance cooperation. The law of the sea governs marine fishery resources by providing preventive and curative solutions [109]. Therefore, enhancing the effectiveness of international law is an effective solution to reduce the negative impact of the securitization of the maritime commons on international cooperation in sustainable fisheries. This includes establishing minimum and enforceable standards and improving compliance by all parties [80], which can reduce the cost of cooperation, thereby promoting it.

In addition, the international legal framework shifting its focus from states to non-state actors and regional cooperation governance mechanisms can be an effective option. Currently, the international legal framework for sustainable fisheries governance is characterized by focusing on states. However, based on practice experience, non-state actors and regional cooperative governance mechanisms, e.g., RFMOS, may be able to play a more significant role in sustainable fisheries governance. For example, the European Union (EU) performs well in combating IUU fishing as a regional organization. The EU combats IUU fishing through legal documents centered on the EU IUU Regulation, combined with commercial means such as insurance regulations [61]. Likewise, the Conservation of Antarctic Marine Living Resources (CAMLR) and the Commission for the CAMLR, both regional fisheries management organizations, can still guarantee that states cooperate in combating IUU fishing and other issues of sustainable fisheries governance [42].

4.3. Regional Cooperative Governance Mechanisms

Establishing a regional cooperation governance mechanism is crucial for cooperation. An essential role of establishing a regional cooperation governance mechanism is to distinguish the issues in the region into low-level political issues and high-level political issues in the form of legally binding international legal instruments. This can effectively avoid a situation where the securitization of the maritime commons links those issues—such as marine environmental protection, fisheries governance, etc., which have low political attributes—to high political issues. The Arctic Council provides a good example of this. At the beginning of its establishment, the Arctic Council determined that it would not be involved in military security but was committed to governance and cooperation on low political issues such as the environment, climate change, and indigenous peoples [110]. This makes for a clear divide in the Arctic between low-political issues, where it is easier for states to cooperate, and high-political issues, where it is difficult for states to cooperate. Although the Arctic Council was later inevitably drawn into issues related to military security [108], and the Arctic continues to face these problems due to its securitization [27], this distinction remains effective: states are still more likely to cooperate on issues identified as low political issues by the Arctic Environmental Protection Strategy, such as environmental protection [111].

Regarding specific regional cooperation, cooperation on anti-piracy in Somali waters is worth learning from [112]. Somali waters also face the impact of the securitization of

the maritime commons on combating piracy [113], as well as the anti-piracy cooperation mechanism, although the establishment of common interests and strategic mutual trust is still effective. The same has also happened in the Pacific. China and the ASEAN have cooperated on a series of issues and formed a relatively complete cooperation mechanism [114]. By incorporating sustainable fisheries governance issues into these existing cooperation mechanisms or establishing new cooperative cooperation mechanisms based on experiences, the cooperative mechanisms and multilateral international legal instruments can identify sustainable fisheries governance as a low-level political issue and separate it from high-level political issues such as sovereignty, military, etc. On this basis, coastal states can more easily cooperate in the South China Sea. This is an effective solution to reduce the negative impact of the securitization of the South China Sea on sustainable fisheries governance cooperation [114]. In addition, the desecuritization and cooperation mechanism of the Lancang-Mekong River is a good reference for establishing effective regional cooperative governance mechanisms for sustainable fisheries governance [115]. Evidence from the Artic, Somali waters, the South China Sea, and the Lancang-Mekong River shows that the establishment of regional cooperative mechanisms can effectively resist the negative influence of the securitization of the maritime commons on sustainable fisheries governance cooperation, which is achieved by identifying sustainable fisheries governance as a low-level political issue, enhancing trust and increasing common interests.

5. Conclusions

As the discussion of this article shows, the securitization of the maritime commons impacts cooperation on sustainable fisheries governance and places sustainable fishery management and resources at risk. However, the international legal framework for sustainable fisheries governance cannot effectively block negative influence nor promote cooperation among states in this field. Evidence from the Northeast Asia Pacific and the South China Sea on cooperation to combat IUU fishing supports the above conclusion. In theory, the accepted solution is achieving the desecuritization of the maritime commons, while in practice, this solution is hard to achieve. Therefore, it is crucial to decouple sustainable fisheries governance from security issues when it is difficult to achieve the desecuritization of the maritime commons. Decoupling requires a significant improvement in international legal framework and the establishment of further regional cooperative governance mechanisms.

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Maritime Dispute Settlement Law towards Sustainable Fishery Governance: The Politics over Marine Spaces vs. Audacity of Applicable International Law

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Abstract: The present article discusses and analyses the role and contribution of International Maritime Dispute Settlement Bodies in sustainable fishery governance. From a maritime dispute settlement perspective, the discussion on preserving marine biodiversity, including fisheries and ecosystems, is unprecedented. However, dispute settlement impacts on marine biodiversity require serious attention from the viewpoint of effective implementation of the United Nations Fish Stocks Agreement, International Environmental Law, and United Nations Convention on Law of the Sea. 'Applicable law' as primary contention, which could be utilised to preserve marine biodiversity, is preferably employed for 'ship release' and 'delimitation' issues under dispute settlement mechanisms. Perhaps, the political and legal obstacles in interpreting the 'law of the sea' are one area of critique, and the optional dispute settlement mechanism is another. All these significant issues are discussed to develop a rational approach utilising 'applicable law' to preserve marine biodiversity and develop sustainable fishery governance. The result will certainly help build a better understanding of the 'applicable law' jurisdiction that may be utilised to ensure the sustainability of marine biodiversity.

Keywords: maritime dispute settlement law; sustainable fishery governance; preservation of marine biodiversity; United Nations Convention on Law of the Sea (UNCLOS); International Environmental Law (IEL); International Tribunal for Law of the Sea (ITLOS); International Dispute Settlement Bodies (DSBs)

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1. Introduction

Between 1868 and 1873, the United States (US) Congress enacted legislation in order to limit the hunting of fur seals in the Bering Sea [1]. Accordingly, the Bering Sea area was leased to a multinational corporation for sealing under specific circumstances. The legislation maintained that the US had exclusive industrial rights over the fur seals in the adjacent areas [2]. The Congressional Acts allowed the US authorities to capture and detain foreign vessels involved in such idiosyncratic fishing. Later, several Canadian vessels under the British Imperial Flag involved in sealing were arrested and seized by US authorities, following which they were libelled by order of one of the US District Court and their crews were convicted [2]. The British government requested US authorities to release the vessels and determine the *mare clausum* (the jurisdiction of the coastal state over marine area) in the Bering Sea area for sealing and other fishing activities. In response, the US authorities raised concerns regarding the preservation of fur seals and their ecological impact on marine biodiversity in the Bering Sea area. A diplomatic negotiation between the US and Britain followed, eventually failing due to the industrial interests of states involved in the Bering Sea [1].

The infamous *Bering Sea (Fur Seals) Arbitration* involving Russia, the US, and Great Britain, to resolve the catastrophic impact on the marine biodiversity due to diminishing fur seals, somehow shaped the jurisdiction of the modern international courts in settling

maritime disputes [3]. The Arbitral Tribunal in the *Bering Sea Arbitration* established the principles of 'precautionary approach' and 'preventive action' concerning the content of the action, which may cause severe or irreversible damage to marine biodiversity. The given environmental principles were reiterated, particularly in the light of 'scientific evidence regarding the action which may harm the marine biodiversity', by the International Court of Justice (ICJ) in the *Corfu Channel Case* [4]. In a particular outlook, beyond the concept of 'use of force' in the maritime zones, the judgement in the *Corfu Channel Case* systemically integrated the law of the sea and law of naval warfare, which helped develop the law for the preservation of marine biodiversity [5].

It is also hypothetically contended that the arbitral tribunal's decision in the *Trail Smelter Case* significantly impacted the development of Part XII (Protection of the Marine Environment) of the United Nations Convention of Law of the Sea (UNCLOS) [4,6,7]. As the trail smelter caused harm to the crop, it is argued that the extensional damage to the marine habitat and biodiversity due to sulphur emissions was realised by that arbitral tribunal. Through the judgements of the given cases, the principles of 'precaution' and 'preventive action' became a statutory *imprimatur* (an authority) of the International Environmental Law (IEL). It can also be noted that the upcoming marine ecological crisis was already an area of concern in transnational political space. Therefore, the International Maritime Dispute Settlement Bodies (DSBs) to date use the notion of 'prudence and caution', in effect, which means the application of 'the conservation of the living resources of the sea is an element in the protection and preservation of the marine environment' [7,8].

Although the presence of the IEL in existing geopolitical spaces allowed the DSBs to enhance marine environmental protection, strict measures for sustainable fishery governance are still equivocal in modern maritime dispute settlement practice. As 'sustainable fishery governance' is a legal–scientific concept involving habitat and ecosystems, it can be contended that the politically influenced DSBs manoeuvred the whole concept of 'marine biodiversity'. The ICJ, for example, in the first two *Fishery Jurisdiction Cases (United Kingdom v. Iceland; Federal Republic of Germany v. Iceland)*, without any scientific details related to sustainable fishery governance, allowed fishing up to 50 nautical miles [9,10]. Theoretically, this decision of ICJ underpinned the fishing rights of coastal States up to 200 nautical miles (Exclusive Economic Zones or EEZ) under UNCLOS, and this allowed damage to marine biodiversity [9,10].

International Tribunal for Law of the Sea (ITLOS), phenomenally developed for maritime dispute settlement, reinforced 'sustainable fishery governance' as the objectivity of the UNCLOS in the first decisions of *MV Saiga Cases (1 and 2)* [11]. One of the judges of ITLOS, in *MV Saiga Case—1 (Provisional Measures)*, opined that the tribunal would prescribe to binding marine biodiversity preservation clauses under the UNCLOS in its future decisions [12], as ITLOS under UNCLOS, while exercising its jurisdiction for delimitation of maritime boundaries and release of vessels, must also deliberate on the serious harm caused to marine biodiversity. This practice of ITLOS became evident with the decisions of the *Southern Bluefin Tuna (SBT) Cases (Provisional Measures)* [13]. ITLOS, in the cases mentioned above, substantively ascertained its ecological jurisdiction and ruled the importance of marine biodiversity preservation by applying the multilateral (international) environmental agreements (MEAs) along with the UNCLOS. ITLOS employed the principle of 'applicable law' provided under the Vienna Convention on Law of the Treaties (VCLT), amalgamated IEL and UNCLOS, and yielded a firm and robust base of sustainable fishery governance in maritime dispute settlement practice [14–16].

However, most of the issues related to sustainable fishery governance were not addressed as per the applicable MEAs and IEL by the Special Arbitral Tribunals (Special Tribunals formed under the Compulsory procedures of UNCLOS except ITLOS) formed under Part XV of the UNCLOS. As in *MOX Plant* and *SBT (Jurisdiction and Admissibility) Cases*, the Special Tribunals in these cases refused to exercise their jurisdiction to amalgamate MEAs, IEL, and UNCLOS as provided under the 'applicable law' [17–19]. The ecological jurisdiction of ITLOS became controversial through these initial decisions of the Special

Tribunals and caused severe harm to marine ecosystem practice in dispute settlements. Moreover, in *Chagos Marine Protected Areas* and *Arctic Sunrise Cases*, the refusal of DSBs while applying 'applicable law' in a manner extending the jurisdiction provided under the UNCLOS challenged the previous stance of the ITLOS and ICJ [20,21].

In light of the above, it is argued that the DSBs have technically disregarded marine biodiversity preservation as the *ratione materiae* (the main purpose) of IEL and UNCLOS [22]. In matters related to marine biodiversity, the role of DSBs has been critiqued in various ways, and, to some extent, Part XV of the UNCLOS (Settlement of Disputes) has been generously evaluated [19]. The main contention in the existing literature regards the diplomacy of states over fishery governance for trade purposes which had ruled out the alignment of sustainability in the law of the sea [23]. It is also argued that there is a growing impact of global and regional politics on DSBs in maritime dispute settlement practice due to the fishery catches [24,25]. As in any international-public dispute settlement, the geostrategy and political economy are a state's key concerns; there is no long-term agenda to preserve marine biodiversity. Such political influence of the states certainly questions the vitality of the UNCLOS dispute settlement mechanism.

This article focuses on the gaps in the UNCLOS dispute settlement mechanism, which has allowed political enamour and hindered the capability and capacity of the DSBs in the preservation of marine biodiversity. This article first analysed the usage of 'applicable law' in international maritime dispute settlement practice, particularly emphasising the 'law compatible with the UNCLOS'. When the distinction between the usage of 'compatible law' and 'applicable law' became evident, the discussion followed the analysis of political influences on the role of DSBs in the development of sustainable marine biodiversity. Subsequently, a balanced opinion is formed to pave the way for a functional approach under UNCLOS. It is suggested that the jurisdiction of DSBs can be enhanced for marine biodiversity conservation and preservation if the technicality of legal tools and measures is utilised. A formal conclusion follows the discussion on the potential future role of the DSBs in the emerging context of the climate crisis impacting marine biodiversity.

2. Audacity of the 'Applicable Law' in Maritime Dispute Settlement towards Sustainable Marine Biodiversity

2.1. Emergence of Applicable Law in Fishery Governance

The global fishery governance landscape emerged with the two sets of provisions of UNCLOS related to impact and depletion of the fish stocks [26]. UNCLOS deals with EEZ areas to ensure that fishes are maintained and not endangered due to overexploitation by coastal states. The measures are designed to maintain and restore the harvested species at levels that can produce maximum sustainable yield (MSY) [27]. Moreover, the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (UN Fish Stocks Agreement) expanded the jurisdiction of the UNCLOS for the preservation of marine biodiversity [28]. In addition, the Convention on the Conservation Migratory Species (CMS), the Convention on International Trade in Endangered Species (CITES), and the Convention on Biological Diversity (CBD) are important instruments dealing with fishery governance [29–31].

Given the international legal instruments applicable for the preservation of marine biodiversity, it is contended thoroughly that the jurisdiction of the DSBs can be expanded in the context of sustainable fishery governance [22]. Although ITLOS in *MV Saiga Case*, while utilising the 'applicable law' provisions following ICJ's verdict in *Corfu Channel Case*, expanded its jurisdiction and applied the law of the sea in conjunction with the law for the use of force, the overall UNCLOS dispute settlement system has so far been underutilised for taking preservation measures for marine biodiversity [32,33]. Even while observing the ITLOS practice, it became evident that it supervised 'prompt releases' instead of preservation measures. Out of 29 cases submitted, only one core marine environmental protection issue was brought to its attention [32,34]. There are possibly lacunas in the

procedures under the UNCLOS dispute settlement mechanism, which challenge the practice of DSBs regarding the maintenance of marine biodiversity.

The jurisprudence developed under the UNCLOS dispute settlement mechanism evidentially supports the argument that DSBs neglect the overall concept of 'sustainability' in 'marine biodiversity'. Although the UNCLOS dispute settlement system is disappointing for sustainable fishery governance, it helps the economic stability of the coastal states (including their communities, fishers, maritime labourers, etc.). It has also been contended that the presage of 'applicable law' prioritised for prompt release cases and delimitation issues is crucial in establishing regimes for fishery economic development [35]. Moreover, when the DSBs try being preservationists, the subject matter 'dispute settlement' is lost. The conflict in jurisprudence between *SBT (Provisional Measures)* and *SBT (Jurisdiction and Admissibility)* confers that ITLOS attempted 'preservation measures' generally, and the Special Tribunal focused on the swift settlement for mutual cooperation [36,37]. Therefore, the Special Tribunal superseded the ITLOS decision owing to 'stability and preservation' not 'strong sustainability' [38].

In light of the economic viability based on fishery development, it is also opined that negotiations expand the canvas of the policy implementation arena, which can help align sustainable fishery governance with economic stability [39]. The swift expedition in decisions allows the states to focus on the single point rather than the multiplicity of concerns and to strengthen regional and national mechanisms for sustainable fishery governance. In addition, the cost effectiveness of negotiations offers practicality and flexibility, which affects the prudent nature of the decisions [40]. Therefore, the states' trust in negotiations beyond DSBs is growing because the favourable and speedy decisions suit the states' economic sustainability, which at some point preserves marine biodiversity [39,41]. Contrarily, this swiftness is challenged on the basis that, in any negotiation process, economic interests usually control the states' political influence. As in a unique *Swordfish Dispute*, the settlement outside DSBs allowed harm to marine biodiversity [42]. The contention exists mainly on the part of the initial practice of ITLOS in preserving fisheries in *the MV Saiga (Provisional Measures) and SBT Cases*, in which the (flag and coastal) states' economic activity halted. After that, the restriction imposed by the DSBs on themselves in exercising fishery jurisdiction led to both marine biodiversity and economic stability based on fisheries becoming more controversial.

Therefore, before going into an in-depth analysis of the 'applicable law' in the UNCLOS dispute settlement mechanism, it is necessary to understand the difference between 'the law invoking the jurisdiction (under Article 286 of the UNCLOS)' and 'law (compatible) applicable after assuming jurisdiction (under Article 293 of the UNCLOS)' [7]. As a DSB having jurisdiction under the 'Compulsory Procedures Entailing Binding Decision' of the UNCLOS, it shall apply the compatible rules of international law related thereto [7]. Any DSB can also assume jurisdiction if any MEA (including fishery law instruments) related to UNCLOS is submitted to it and is empowered to interpret and apply that MEA. The DSBs, in this case, are also not prejudiced if the parties agree to decide an issue using the principle '*ex aequo et bono (according to the right and good)*' beside the legal provisions of UNCLOS [43]. However, this legal position contradicts the UNCLOS 'compulsory procedure' requirements because a DSB having jurisdiction over any dispute concerning an MEA may not require the parties' consent [40]. Therefore, the precedents in maritime dispute settlement have become quite contentious due to the vast discretionary interpretative and remedial powers available to the DSBs.

It is also notable that the UNCLOS dispute settlement provisions establish a wide range of DSBs, and it is imperative to ensure that their *modus operandi* would be appropriate in dealing with issues of a similar nature [43]. Of the four UNCLOS dispute settlement options (ICJ, ITLOS, arbitration, and special arbitration) made available to the states, preference is given to special arbitral proceedings [44]. In addition, the special arbitral proceedings are relatively costly and have to be financed entirely by the states and may concern the use of public funds under scrutiny. Thus, it can be hypothetically conceded that the Special

Tribunals are constituted politically, and, in practice, it is a difficult task for them to satisfy the preconditions of the UNCLOS 'applicable law' for sustainable fishery governance [45]. This overabundance of the DSBs has led to the varying interpretation of the UNCLOS and the 'applicable law' (MEAs and IEL) connected thereto [45]. Therefore, the DSBs have both assumed and rejected 'applicable law' jurisdiction, albeit in more sensitive yet significant ways, such as through the clarification of the rules and principles governing fishery.

In general, the 'applicable law' provisions of VCLT and Statute of the ICJ do not expand or invoke the jurisdiction of DSBs [14,46]. Therefore, the jurisdiction of ITLOS is invoked under the provisions of the UNCLOS and not prejudiced from settling the questions related to 'law not incompatible with' [47]. Because the jurisdiction assumed under the Statute of the ITLOS 'comprises all disputes and all applications submitted in accordance with the UNCLOS, and all matters specifically provided for in any other agreement which confers jurisdiction on the ITLOS' [48,49]. Accordingly, ITLOS can assume jurisdiction on the basis of any agreement (MEA) directly conferring or in the extension of UNCLOS. *The MV Saiga Case* is notable here, through which ITLOS inaugurated its jurisdiction and used the 'applicable law', i.e., UNCLOS and law on the use of force [50]. Through this case, ITLOS challenged the overgeneralisation of international dispute settlement practice and somehow justified the expansion of the jurisdiction provided under UNCLOS, as well as the ITLOS Statute [12]. While concluding, ITLOS stated that the 'use of force' is outside the scope of UNCLOS but compatible, and application is required to avoid the multiplicity of the proceedings and strengthen future actions to be taken by DSBs in similar disputes [51].

2.2. Applicable Law in Fishery Dispute Resolution

In light of *the MV Saiga Case*, the scope granted to the jurisdiction of the DSBs is vast and enables multiple dimensions of interpreting the law of the sea by amalgamating UNCLOS and other compatible rules of international law. Following this, ITLOS advanced the provisional measures for sustainable fishery governance in *SBT (Provisional Measures) Cases* under provisions of MEAs and UNCLOS. ITLOS assumed jurisdiction in extenso that 'general, regional, and bilateral agreement' can be applied under the UNCLOS dispute settlement mechanism [7,37]. Although in *SBT (Provisional Measures) Cases*, the parties were abstained from fishing according to MEAs, the jurisdiction of ITLOS was invoked under the UNCLOS. However, notwithstanding the decision of ITLOS, the reluctance of applying 'applicable law' by the Special Tribunal in *the SBT (Jurisdiction and Admissibility) Case* invoked all sorts of creative arguments [36]. The criticism, interestingly, considered that the jurisdiction provided under UNCLOS is weak, and it also asserted that the precedential value of *the SBT (Jurisdiction and Admissibility) Case* will cause restrictive *renvoi* (choice of law) in future maritime dispute settlements.

The *MOX Plant (Provisional Measures) Case* was the test for the ITLOS (as well as for the DSBs) environmental *compétence de la compétence* (the powers of DSBs to assume their ecological jurisdiction, which may seem obvious) [52]. In this case, the jurisdiction of UNCLOS for marine biodiversity preservation would have been strengthened [53]. The issue concerned a nuclear plant operated by the United Kingdom in the Irish Sea, 184 kilometres away from Ireland's coastline. Ireland invoked the jurisdiction of ITLOS, considering the substantive UNCLOS perspective, and put forth a Ministerial Declaration and the Convention for the Protection of the Marine Environment of the Northeast Atlantic (OSPAR Convention) [54,55]. Although ITLOS seemed attractive for provisional measures, it rejected the environmental claim in extenso submitted by Ireland against the United Kingdom and asserted that any non-UNCLOS perspective (OSPAR Convention) is inadmissible [23]. The decision restricted the *renvoi* of the ITLOS, even given uncertainty about precisely what provisional measures might be issued and how any DSB would resolve controversial 'applicable law'.

Even though Ireland cited the *MV Saiga Case* in order to establish the authority of the ITLOS to determine the violation of a certain MEA, the issues of 'applicable law' were not that much logically answered in the decision of the *MOX Plant (Jurisdiction and Admissibility)*

Case [18,56]. ITLOS hypothetically contended that there is a distinction between jurisdiction provided under 'applicable law' and 'international agreement related to the UNCLOS' [56]. The Special Tribunal more technically handled this question constituted by the Permanent Court of Arbitration (PCA) at the request of Ireland for the final award of the dispute. The Special Tribunal followed the arguments submitted by the United Kingdom that any DSB constituted under the UNCLOS can determine 'applicable law' if there is a violation of secondary rules of international law. The applicability of VCLT is relevant if an MEA is constituted under the law of the sea provisions and there is any express *renvoi* provision [57]. In arriving at a decision, the Special Tribunal, unfortunately, certainly did not clarify the interpretation of 'applicable law' and 'MEA related to the UNCLOS'. The decision was made with the majority of votes, which refused the plurality of the international law dealing with one issue in hand, i.e., the dispute under MEA should be resolved first, after which the UNCLOS dispute settlement mechanism can be used [58].

Unfortunately, the Special Tribunal never executed an award in the *MOX Plant* case and opined that 'any dispute under an agreement does not become a dispute under the other (UNCLOS) due to the same substance of that dispute' [59]. The *MOX Plant Dispute* arose under 'the OSPAR Convention, which existed separately from the UNCLOS'. Thus, the Special Tribunal assumed jurisdiction *prima facie* and refused to continue because the issues under OSPAR Convention were narrower than under the UNCLOS. It was also stated that the OSPAR Convention establishes exclusive jurisdiction of the European Court of Justice [60]. Therefore, the Special Tribunal stayed the proceedings on the request of the United Kingdom and requested the parties to obtain the jurisdiction from the European Court of Justice according to the Treaty establishing the European Community (EC Treaty) and the Treaty establishing the European Atomic Energy Community (Euratom Treaty) [32]. Such a position of the Special Tribunal again gave weightage to an MEA over UNCLOS, and the stance of the European Court of Justice unequivocally, in this case, ruled out the importance of the law of international marine environmental protection.

The disposition of the DSB was later followed in *ARA Libertad, Chagos Marine Protected Areas*, and *Arctic Sunrise cases* [20,61–63]. The criticism was logically answered that 'applicable law', in the UNCLOS, does not inherently constitute a basis of jurisdiction and it requires 'an agreement related thereto'. Without commenting on the previous decisions, such as the ITLOS in *MV Saiga* and *SBT (Provisional Measures) cases*, although submitted by the parties, the Special Tribunal's decision in the *Arctic Sunrise Case* answered that 'applicable law' does not extend the scope of jurisdiction' [64]. The Special Tribunal technically distinguished the *MV Saiga* and *Arctic Sunrise cases* on the basis of customary (primary rules of) international law and treaty law [63]. These decisions were quite controversial, in which DSBs opined that 'applicable law' was not used in *MV Saiga* and *Southern Bluefin Tuna Cases*, and, although used by the ITLOS, it constituted a weak position of the UNCLOS dispute settlement mechanism [65].

The fishery (and marine environmental) disputes settled somehow by the ITLOS as mentioned above are notable regarding the practice of DSBs in preserving marine biodiversity. The initial position of ITLOS seemed axiomatic in protecting marine biodiversity by using judicial powers and referring parties for negotiations. It was made clear by the Special Tribunal that the ITLOS and all other DSBs can only deal with issues that are submitted to it with the consent of the parties to a dispute. Thus, in *SBT (Admissibility and Jurisdiction)* and *Swordfish cases*, the DSBs were reluctant to apply the MEAs along with UNCLOS provisions because consent was missing [53]. Similarly, justiciability prevailed in *the MOX Plant Case* when ITLOS refused to expand environmental jurisdiction under 'applicable law' provisions. ITLOS attempted to vindicate the compulsory dispute settlement mechanism under the UNCLOS and established that the paradox of choice (also known as 'the Montreux formula') allowed the Special Tribunals to cast problems for using expansive jurisdiction with 'applicable law' [66,67].

2.3. Impartial Utilisation of Applicable Law for Fishery Preservation

Given above, the powers of DSBs were shrinking while interpreting 'the law compatible with UNCLOS'. The impact of this practice on ITLOS was considerably prominent in *the Volga Case* [68]. *The Volga Case* was doctrinaire as a 'vessel release issue' by the ITLOS, but it was about illegal, unreported, and unregulated (IIU) fishing [69]. ITLOS, in this case, disregarded Australian domestic legislation developed under the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR) and remained silent on the implementation of the Fish Stocks Agreement [28,70]. A Russian vessel, *Volga*, involved in IIU fishing in the Australian EEZ, was arrested and penalised thrice by Australian authorities under CCAMLR and domestic legislation. Russia submitted to ITLOS regarding the 'prompt release' of *Volga* as per the procedure laid down in UNCLOS. Australia argued that the CCAMLR's provisions related to IIU fishing must be considered, and that the tripartite monetary penalties and a nonfinancial bond for release applied to the *Volga* under domestic legislation should remain per se [71].

The potential role of ITLOS in *the Volga Case*, which was expected to be favouring sustainable fishery governance, was once again under intense criticism. Intriguingly, in this case, a fishery MEA (CCAMLR) was competing with the UNCLOS 'prompt release measures' [72]. ITLOS, while attempting to 'preserve a balance between the economic interests of the flag state and the marine biodiversity of the coastal state', prioritised UNCLOS over CCAMLR and contradicted previous precedents. With this idea of balancing and assuring a 'reasonable bond or other security', ITLOS ordered the release of the vessel and stated that 'Australia's demands were not reasonable under the UNCLOS provisions related to prompt release' [73].

The assumption of jurisdiction by the ITLOS in *the Volga Case* was primarily based on UNCLOS prompt release measures. UNCLOS superseded the CCAMLR (an MEA), as ITLOS stated that this case was different from a fishery dispute [74]. Essentially, the *Volga Case* was not a fishery dispute submitted to the ITLOS by Australia; it was a 'prompt release matter' brought by Russia. Although the ITLOS opined that Australia was exorbitant in this case and requested to revise the penalty imposed by the domestic authorities, it also appreciated the actions taken by states in the CCAMLR area. In this way, the ITLOS accepted the CCAMLR's application in that area in a sensible way and rejected the application of a fishery MEA in any dispute settlement in a technical way [32]. ITLOS also demonstrated its jurisdiction in a clear path that treatment of a pure fishery dispute would be different against any prompt release issue. Through this decision, finally, the issue of CCAMLR went to the Australian authorities for more stringent measures to control IIU fishing as suggested by the ITLOS.

The point urged in *the Volga Case* that the DSBs are to settle disputes relating to specific situations and not make laws and solutions to the marine biodiversity also provided clarity that pollution- and fishery-related issues require coordinated action on the part of the states [75]. It also became apparent that the cases submitted to the DSBs are to clarify the obligations and responsibilities of states. The judgements contributed to the effective implementation of the UNCLOS, as DSBs encouraged the states to negotiate on measures for the conservation and management of marine biodiversity [36]. In view of this, the developed jurisprudence in international maritime dispute settlement gained recognition. The DSBs determined what role the UNCLOS dispute settlement system can play. Moreover, fishery preservation as an essential concomitant of the marine biodiversity under the UNCLOS was dealt with in a controversial manner but in a sensitive way, and this alarmed the international political arena regarding sustainable fishery governance.

Recognising the issues related to ocean sustainability, the International Seabed Authority (ISA) requested the ITLOS (Seabed Dispute Chambers) for an advisory opinion related to *Responsibilities and Obligations of States Sponsoring Persons and Entities with Respect to Activities in the Area* [76]. Interestingly, this request came years after the Fish Stocks Agreement under the UNCLOS, as the ISA was already governing the exploration and exploitation in 'the area' long ago [77,78]. ITLOS, while responding to the request of ISA,

defined the 'obligations of the states' that are conducting economic activities in 'the area' beyond national jurisdiction. ITLOS defined the 'obligations of the state' by reading the relevant part that 'states shall have the responsibility to ensure that activities in the area shall be carried out in conformity with the UNCLOS' [79]. In this way, ITLOS underpinned the states' due diligence and recognised applying the 'precautionary approach' as per the Rio Declaration on Environment and Development (Rio Declaration) [77,78]. It can be hypothetically contended that ITLOS as a DSB challenged its previous position and applied 'applicable law' provision through this opinion. At the same time, it is also notable that advisory opinion does not constitute an 'obligation' to be implemented, and the Rio Declaration was a 'compatible law' rather than an 'applicable law' [80].

With reservations, it can be said that ISA's request was to define the '*liabilities and obligations of the States in the Area*', and ITLOS advised with clarity. ITLOS trimmed its jurisdiction in this case, and it did so because it simultaneously imposed responsibility on ISA and the states [80]. ITLOS said that 'if a state has taken all the necessary measures (policies, laws and regulations) to secure compliance, it shall not be liable for any damage to the marine biodiversity (including sustainable fishery governance)' [79]. The states are obliged under the UNCLOS to assist the ISA, and ITLOS recognised the 'direct obligations' through the due diligence to ensure 'best fishery governance practices' [47]. ITLOS further adumbrated that 'if damage occurred, and the state had failed to take all necessary and appropriate measures to ensure compliance, then the state would be liable' [81]. From the perspective of IEL, this opinion is historical, and ITLOS set the highest standards for sustainable fishery governance by endorsing a legal obligation to conduct environmental impact assessments (EIA) [81]. Despite the relative clarity made on its jurisdiction, the position of ITLOS on EIA was somehow controversial because the ISA was empowered to determine environmental standards [81]. The approach made for EIA appeared towards a global approach rather than a national approach. Thus, ITLOS informed sensitively that judicial bodies are empowered to advise the relevant authorities on the interpretation and implementation of UNCLOS in conjunction with 'compatible law'.

The disposition taken by the ITLOS in *Responsibilities and Obligations of States in the Area* was maintained in another advisory opinion requested by the *Sub-Regional Fisheries Commission (SFRC)* [82,83]. ITLOS assumed jurisdiction directed by the Convention on the Determination of the Minimal Conditions for Access and Exploitation of Marine Resources within the Maritime Areas under Jurisdiction of the Member States of the Sub-Regional Fisheries Commission (CRFC) [84]. ITLOS reasoned that all matters referring closely to the purposes of the UNCLOS empowers CRFC officials for an advisory opinion [85]. ITLOS clearly endorsed CRFC as 'compatible law' under the relevant provisions of the UNCLOS for sustainable fishery governance. Although many states refused to accept the proceedings, ITLOS assumed jurisdiction on the basis of ICJ's practice that advisory opinions are non-binding [86]. In such a manner, ITLOS proceeded without the consent of all states, as well as without answering that only one chamber within is allowed for an advisory opinion (i.e., Seabed Disputes Chambers).

The opinion requested by *SFRC* was related to IUU fishing and the responsibilities of the states under UNCLOS and an MEA (CRFC). ITLOS again edged its jurisdiction while answering controversial questions, such as the states' obligation under CRFC in curbing IUU fishing [87]. Instead, ITLOS said that it is a primary responsibility of the states under UNCLOS 'to take necessary measures to prevent, deter, and eliminate IUU fishing'. ITLOS strengthened its position by referring to the 'obligation' of the states as per opinion in *Responsibilities and Obligations of States in the Area* [88]. ITLOS also re-endorsed 'due diligence' and 'liabilities' of the states to preserve the marine biodiversity under the UNCLOS [89]. Furthermore, ITLOS requested states to 'cooperate and coordinate' according to 'best scientific information' to 'ensure the preservation of marine biodiversity', including fishery stock [90].

ITLOS as a DSB, through the advisory opinions, clarified that it could assume jurisdiction if any compatible law (with UNCLOS) confers jurisdiction to it [91]. For the

interpretation of UNCLOS, ITLOS can apply the 'applicable law' or 'compatible law' but cannot interpret any MEA without the consent of states (parties) [92]. For the purposes of advisory opinions, the consent of states is not necessary because opinions are not binding [88]. ITLOS can urge states (only) for taking particular legal and governance measures for fisheries because it is a 'due diligence obligation'. In this way, ITLOS informed how far jurisdiction could be exercised under UNCLOS. The advisory opinions were balanced, bold, and forward-thinking in instances of *erga omnes* (towards all) for sustainable fishery governance.

Following the practice of the ITLOS and for the justiciability of marine biodiversity, a very recent decision of the Special Tribunal constituted under the PCA in the *South China Sea Dispute* is significant [93]. As the *South China Sea (Dispute)* is an area of crucial shipping lanes and enriched resources, this dispute *prima facie* (on the face of record) is considered a case of maritime boundary delimitation [94]. The decision in this dispute covers marine biodiversity issues from fishery, pollution, and development (of islands) perspectives [95]. The Special Tribunal stated that it could not assume jurisdiction on the violations related to the IEL, such as the CBD and CITES; nevertheless, the jurisdiction provided under the UNCLOS allows taking measures in preserving marine biodiversity [96]. The Special Tribunal, thus, relied on the provisions of UNCLOS for marine biodiversity preservation and was reluctant to utilise 'applicable law' provided to apply MEAs and IEL.

In the *South China Sea Dispute*, the Special Tribunal found grave violations of UNCLOS and regional MEAs by states in the South China Sea area. It urged to stop island-building activities and reinforce the preservation of marine ecosystems, including reefs and fisheries [97,98]. The Special Tribunal, while using its own expertise for scientific–environmental determinations, inter alia, relied on ITLOS's advisory opinion '*Activities in the Area*', and explained that it is the obligation of the states under (regional and international) MEAs and UNCLOS to preserve the marine resources (oil and gas), minerals, and fisheries to maintain marine biodiversity [93]. In addition to endorsing due diligence as a positive obligation and liability of the states concerning curb IUU fishing, the Special Tribunal also stated a negative obligation 'not to degrade marine biodiversity' by constructing artificial islands [99]. In this degree, the Special Tribunal achieved a complete description of sustainable fishery governance, including marine environment, ecosystems, and biodiversity.

The Special Tribunal's substantive findings in the *South China Sea Dispute*, and the jurisprudence related to the fishery governance developed by ITLOS in Advisory Opinions were both based on the infamous decision of the ICJ in *the Pulp Mills Case* [100]. As in the *Pulp Mills Case*, the ICJ referred to 'corpus of IEL' as a 'general obligation of states to ensure that the activities within their jurisdiction and control respect the environment of other states or areas beyond national control' [101,102]. The ICJ in the *Pulp Mills Case* also considered the EIA and disclosure of environmental information as due diligence under the Rio Declaration and as part of IEL. The Special Tribunal and ITLOS as DSBs agreed to this position of the ICJ in quite a subtle manner by only stating the provisions of the UNCLOS related to marine environmental protection. Both the DSBs decided that the obligations related to marine biodiversity preservation are applicable to all the States in all maritime areas, i.e., 'both inside the national jurisdiction of the state and beyond' [86]. In sum, the recent interpretation of the UNCLOS by DSBs explained that the extent of the activities in the oceans, which cannot harm the marine biodiversity of other states, is necessary for sustainable fishery governance.

3. The Politics of the States over Marine Spaces

3.1. The Political Landscape of Southern Bluefin Tuna Cases

The political influence over the UNCLOS dispute settlement mechanisms is noteworthy, which hinders the proceedings and causes severe threats to sustainable fisheries governance. It is also pertinent to mention that the dogmatic decisions also precisely impact the national fishery governance regimes. The principal focus has been with respect to criti-

cal analysis of specific claims related to marine areas, fisheries, or vessels [32]. Governance of fisheries for sustainable marine biodiversity, whilst still an area of IEL blended with UNCLOS, is discussed in a limited fashion in the maritime dispute settlement domain [103]. The impetus is on the states' practice in maintaining marine areas because the UNCLOS objectives, purposes, and *travaux préparatoires* (documented aims) are unlimited, and the only canvas measuring applicability is 'governance of the fisheries' [104,105]. In this scenario, it can be argued that the criticism on DSBs generally ignores the state practice of fishery governance. There are procedural lapses in state practice of fishery governance, and this hinders the implementation of judicial decisions that may impact the sustainability of marine biodiversity [106]. Accordingly, the criticism on this ground can initially contend that political capture on fishery governance and limited jurisdiction provided under UNCLOS impedes the role DSBs in ensuring sustainable marine biodiversity.

The DSBs, while taking provisional measures, are prescribed 'to prevent serious harm to the marine biodiversity, pending the final decision' in many cases. Effective implementation of provisional measures by the states, even though ordered by the DSBs, was, and is still questionable. The Japanese position in *SBT Cases (Provisional Measures)* evidentially supports this argument [17]. As in *SBT Cases (Provisional Measures)*, the ITLOS, on request of Australia and New Zealand, restricted Japan's unilateral experimental fishing of southern bluefin tuna stock [107]. Japan contended the ITLOS interlocutory order on the basis that there is not going to be an irreparable loss to the southern bluefin tuna stock [108]. Japan also challenged the jurisdiction of ITLOS by characterising Convention for the Conservation of Southern Bluefin Tuna (CCSBT) as *lex specialis* (special law prevail over general law) over the UNCLOS [109]. Surprisingly, Japan agreed to the proceedings later, took provisional measures, and submitted to the ITLOS to prescribe Australia and New Zealand to resume negotiations for experimental fishing under the provisions of CCSBT [36].

Given the provisional decision of the ITLOS, it was expected that the formal Special Tribunal to be formed under the UNCLOS would uphold previous measures for sustainable fishery governance [110]. However, the Special Tribunal dashed the hopes, concluded that it lacked jurisdiction to ban any fishing, and revoked the previous order of the ITLOS [110]. While relinquishing its jurisdiction on the ground that the CCSBT specifically required consent of the parties in its dispute settlement proceedings, the Special Tribunal set aside the compulsory jurisdiction of UNCLOS and cast doubt on the historical development of the law of the sea [17]. The precedential value of this decision conflicted with the principle of 'applicable law', thereby drastically impacting the jurisdiction of the DSBs in applying IEL and UNCLOS for sustainable fishery governance [37]. Moreover, the CCSBT superseded the UNCLOS through this decision, and this suggests that if a trilateral MEA or fishery agreement can overthrow the UNCLOS, then national mechanisms of fishery governance can overrule the IEL.

3.2. The Disputed Decisions in Swordfish Cases

The Swordfish Dispute is an equivalent case dealing with the damage to fisheries, which also dismayed the preservation of marine biodiversity [42]. In this case, the European Community (EC) lodged its complaint before the World Trade Organisation (WTO) concerning the laws of Chile prohibiting the unloading of swordfish in Chilean ports. The EC's complaint was based on a violation of the General Agreement on Trade and Tariff (GATT) and claimed that measures taken by Chilean authorities are inconsistent with the WTO commitments [111]. In response, Chile submitted a case in the ITLOS concerning the conservation of the swordfish stock for overall sustainable marine biodiversity [112]. Unfortunately, the EC and Chile reached a provisional agreement prior to formal proceedings in ITLOS and WTO and governed the swordfish stock through their own regimes [113]. There have been contentions that if the IEL and UNCLOS would have *mutatis mutandis* (likewise) applied under the provision of 'applicable law', there were high chances that Chile would have succeeded in the conservation of the swordfish [53].

It was not realised that the 'compatible law' for the primary regulatory purposes of the UNCLOS is more relevant than the 'applicable law' for marine biodiversity. Moreover, the 'applicable law' is ill-defined, mutable, and applied inconsistently from case to case to serve the desired outcomes [114–116]. The argument that 'the DSBs can expand their jurisdiction under UNCLOS and can apply IEL simultaneously under the phrase commonly referred to as 'applicable law' initially appears modest [40]. It becomes complex when the relevant provision used for dispute settlement under the UNCLOS seeks consistency of the IEL, which can be applied with the law of the sea [84,117]. The 'applicable law' for 'applicability of other rules of international law' contradicts itself regarding the interpretation of the UNCLOS [118]. The primary problem is the repetitive use of 'other rules of international law', and these other rules can be used under the UNCLOS for regulation of 'territorial sea', 'innocent passage', 'ships', 'straits', 'exploration in the economic zone', 'using high seas', and 'underwater cultural heritage' (see Articles 2, 19, 21, 31, 34, 58, 87, 138, 293, 297, and 303 of the UNCLOS). Therefore, the challenge faced by the DSBs in utilising 'applicable law' for sustainable fishery governance is technical because, in the UNCLOS, insufficient weight is given to marine environmental protection.

In this context and as discussed already, it is also notable that the states are entitled to submit any dispute related to fisheries [32]. Using the broad *locus standi* (position in front of the court) under the UNCLOS, the states attempted to invoke the 'applicable law' provision from the VCLT's interpretation perspective [110]. However, the consent of the states for the VCLT's 'applicable law' is relevant because 'application of successive treaties relating to the same subject matter is conducted if there is any inconsistency' [37]. The DSBs have used this VCLT provision for prioritising any MEA relating to fishery governance adopted post UNCLOS and explicitly refused to exercise compulsory dispute settlement provisions [37]. The MEAs ratified after UNCLOS, in this scenario, have become superior if not compatible with the UNCLOS, and they have challenged the vitality of the jurisprudence of DSBs.

In this context, it can be argued that the UNCLOS dispute settlement mechanism is satisfactory. Although the ITLOS offers speed and efficiency in taking provisional measures to preserve marine biodiversity, it does not suit the fishery-governing instruments of the states. The states, existing in modern geopolitics, require sustainable solutions, which are guaranteed by negotiations. The practitioners adopt the functional approach of negotiations in maritime dispute settlement and suggest that DSBs should avoid multiple objectives of UNCLOS and IEL [75]. The DSBs matter primarily because they create focal points for sustainable fishery governance by integrating UNCLOS and IEL; thus, conflicting MEAs disrupt the value of precedents by creating additional possible crucial biodiversity issues [36,100,119]. DSBs, through their precedents, create overlapping legal mandates contradicting each other, which weakens the states' claims and obligations. This happens because international law is not well established in dispute settlement, and the option of having a DSB of choice under UNCLOS allows the states to bypass legal obligations [113]. Therefore, the decisions of the DSBs contend state ocean or fishery (or marine environmental) governance regimes with a lesser degree of clarity.

The outcomes of these practices indicate that the dispute settlement outside the DSBs have more authority in national fishery governance regimes and preserve marine biodiversity to an extent [43,120,121]. That said, the importance of international law is still unequivocal, as the political enamour of the states is established through MEAs to manoeuvre the UNCLOS dispute settlement mechanism [40,60,122]. For example, in the *Swordfish Dispute*, the rules of UNCLOS and GATT were inconsistent but influenced the provisional agreement between EC and Chile and established a supplementary judicial system under international law [113]. Similarly, the CCSBT is framed under the provisions of the UNCLOS and impacted the formal negotiations between Japan, New Zealand, and Australia [37]. The provisions of the UNCLOS, related to 'states' duty to cooperate for conservation of living resources and maintaining populations of harvested species to a sustainable yield', remained applicable in agreements concluded through fisheries disputes.

The DSBs ignore the fact that the negotiations that led to UNCLOS came at a time of chaos in marine spaces and maritime disputes [99]. The MEAs, IEL, and UNCLOS can complement or clash in the existing global policy pattern. Thus, the rules created by DSBs in various conflicts caused uncertainty and provided an opportunity to examine the bargaining political power of the States over international law. In any such examination, the practitioners underpin the 'political power of the states' in negotiating disputes outside of the DSBs, as the bilateral agreements are more reliable than seeking the difficulties related to the interpretation of the inconsistent international law [53]. There were circumstances where the methods of 'amicable dispute settlement' prevailed over the compulsory procedures available in UNCLOS. The settlement outside the DSBs mutually benefited the states by forming clear, precise, and vital fishery governance mechanisms.

The above debate suggests that the criticism is based on a more idealistic approach. The imprecise boundaries provided under the UNCLOS compulsory dispute settlement mechanisms challenge the role of DSBs to intervene in national fishery governance mechanisms [49]. Accepting that the jurisdiction of the DSBs is precluded owing to the inconsistencies in international law, the reluctance to treat the disputes under the 'applicable law' provisions available in UNCLOS and VCLT is questionable [40]. However, the states followed the path of the UNCLOS dispute settlement mechanism and applied IEL and law of the sea provisions in outside settlement [72]. Conclusively, even with inconsistencies in international law, the DSBs remain relevant by narrowing the role of states in political-based bargaining. Therefore, it can be assumed that the jurisdiction of the DSBs can achieve sustainable fishery governance and preserve marine biodiversity by adopting a technical and functional approach.

4. The Way Forward

Although the DSBs were asked multiple times recently to restrict rather than expand their jurisdiction under 'applicable law', the effectiveness of 'compatible law' prevailed. The DSBs exercised jurisdiction because any MEA can be used to resolve the dispute under the UNCLOS. The interaction between the provisions related to 'applicable law' and 'compatible law' provided a functional and technical approach to DSBs to resolve conflicts by establishing a clear hierarchy among international legal instruments, i.e., UNCLOS, MEA, and IEL. The DSBs provided a clear direction when faced with inconsistent international law, and the VCLT's 'applicable law' was used to bring fishery governance MEAs under one guiding body (UNCLOS) to create a common interpretation [123]. As VCLT established rules for treaty interpretation, DSBs adopted parameters in translating the UNCLOS [124]. Moreover, the UNCLOS codified customary law of the sea was primarily concerned with bilateral agreements of that time, and this weighs the argument that it is also applicable to most MEAs [125–127].

Before reaching any conclusion regarding the political control over the UNCLOS dispute settlement mechanism, it must be considered that the DSBs sensibly used 'applicable law' for sustainable fishery governance, as well as the economic interests of the states. If the DSBs established under the UNCLOS were influenced, it must have caused ignorance of 'applicable law'. As discussed above, there were logical reasons provided by the DSBs when jurisdiction was declined under the MEAs prevailing over UNCLOS. The point is that the DSBs established under the UNCLOS have a lot of discretion in deciding matters related to fisheries [128,129]. In this scenario, the role of international organisations related to ocean governance also becomes pertinent because these organisations can invoke advisory jurisdiction related to fisheries under the UNCLOS [91]. The DSBs can exercise their jurisdiction to establish more state responsibility for sustainable fishery governance.

Having discussed the technical and functional approach of the DSBs to exercise fishery jurisdiction, the provisions related to the preservation of marine biodiversity of the UNCLOS are relevant. The question arises regarding 'how the DSBs can benefit from any 'MEA' related to these provisions'. Against the applicability of the 'applicable law' for sustainable marine biodiversity, the 'compatible law' reflects that these provisions can be

expanded to an extent [32]. For example, in any event of a dispute, the interpretation of the provisions related to 'regional cooperation for fisheries preservation' in the UNCLOS becomes functional under that MEA. Moreover, regional cooperation has been increasingly observed in practice, the literature, and policy instruments [90]. There are regional fisheries agreements, as well as the United Nations Regional Sea Programmes, implemented by states [103]. While considering regionalism, the state practice of fishery governance aligns with the regional marine biodiversity preservation regimes. On account of this, the DSBs can extend jurisdiction under the regional MEAs (if not explicitly excluded) if it needs to interpret provisions related to 'marine biodiversity preservation' [130].

Most recently, regional cooperation has been endorsed for 'climate action' and in marine environmental governance practice as 'ocean action' [103]. The DSBs could face climate change in the near future because the anthropogenic changes in the physical, economic, social, behavioural, and other factors threaten sustainability in marine biodiversity. The judgement of ITLOS in *SBT (Provisional Measures)*, in this scenario, is quite relevant, as it highlighted 'the protection and preservation of the living resources of the sea, adding in the conservation of the marine environment and the stock of bluefin tuna which was depleted to its lowest levels and was a serious threat to the biological diversity' [131]. Considering the biological diversity, the climate change impact on marine biodiversity can expand the jurisdiction of the DSBs under the UNCLOS even to land-based sources of marine pollution impacting fisheries. Therefore, it can be assumed that there will be new challenges for the DSBs as faced by the international community in the law of the sea matters.

5. Conclusions

As the discussion of this article shows, the jurisprudence under UNCLOS illustrates trends in the field of sustainable fishery governance and marine biodiversity. This article is expected to serve as a starting point for understanding the complexities surrounding the DSBs using the 'applicable law' for marine biodiversity preservation. It is difficult to arrive at a normative conclusion concerning the exercise of 'applicable law' jurisdiction by the DSBs for sustainable marine biodiversity; it appears that assuring the balance between environment and development is going to challenge the jurisprudence applied so far. Furthermore, many of the questions raised in this article have yet to be answered by the DSBs. Previously, the primary issues relating to UNCLOS were delimitation, arrest and detention of ships, and fisheries, and, as of now, there are new global challenges. As a result, it is imperative that the DSBs engage in more significant discussions of the complex issues to prepare for the rising tide of dispute settlement impacting global ecological challenges.

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Illegal, Unreported, and Unregulated Fishing Governance in Disputed Maritime Areas: Reflections on the International Legal Obligations of States

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Abstract: Illegal, unreported, and unregulated (IUU) fishing in the disputed maritime areas causes significant damage to the marine ecology and authorized fisheries, increases the risk of conflicts among disputed states, and violates human rights at sea. Both unilateral measures and cooperative governance for IUU fishing are often inadequate in these areas. In light, this study aims to clarify the regulatory obligations of relevant states and explore feasible solutions based on international cooperation to promote IUU governance in disputed areas worldwide. The rapidly evolving international fisheries legal framework requires that states, such as coastal states, flag states, port states, or market states, fulfill their respective obligations to prevent and deter IUU and that the presence of disputes in a specific maritime area does not typically constitute grounds for derogation from these obligations or exemption from possible state responsibility. However, the implications of the conflicting claims in disputed maritime areas should be taken into consideration while interpreting and applying international legal rules. Therefore, this study suggests that regional and inter-regional cooperation is necessary for states to fulfill their obligations to regulate IUU fishing and prevent state responsibilities under international law. Parties to the dispute, as well as third parties, are encouraged to participate in the cooperative mechanism in order to coordinate legislative and enforcement measures and advance the institutionalization of IUU fishing regulation in the disputed maritime areas, which will not only advances the effective governance of IUU fishing but also reduces tensions among the disputing states and contributes to the peaceful settlement of the dispute.

Keywords: IUU fishing; disputed maritime area; competition of jurisdiction; cooperative mechanism

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1. Introduction

Since the 1950s, the ability to exploit living marine resources has become easier with the advancement of human knowledge of marine science and the rapid development of motorized fishing vessels and trawl fisheries [1]. At the same time, the worldwide consumption of fish and fish products is also significantly increasing. The world per capita fish consumption increased from an average of 9.9 kg in the 1960s to 14.4 kg in the 1990s, 19.7 kg in 2013, and over 20 kg in 2015 [2]. According to the Food and Agriculture Organization of the United Nations (FAO), approximately one billion people worldwide rely on seafood as their main source of animal protein [3]. Due to excess fishing capacity and increasing demand for fisheries, large fish stocks are facing over-exploitation, and humans are experiencing widespread declines in the total biomass of marine resources [4].

In order to protect the global marine ecosystem and ensure the sustainability of the fishing industry, the international community works to improve and advance the international fisheries law. However, attracted by the enormous benefits at hand, some countries still continue to engage in illegal, unreported, and unregulated fishing (IUU fishing) activities in major waters around the world, especially in the exclusive economic zones (EEZs)

and high seas. According to some authors, IUU fishing significantly undermines national, regional, and global efforts to conserve and manage fish stocks, hinders sustainable development, and significantly harms responsible, honest, and lawful fishermen and must be prohibited [5]. Today, the international community has agreed to reduce and eliminate IUU fishing.

In addition to the applicable rules provided by the United Nations Convention on the Law of the Sea (the LOS Convention) for marine ecology and resource conservation, states and international organizations have established a series of legal instruments, both obligatory and regulatory in nature, for IUU fishing. The 1993 FAO Compliance Agreement specifies the obligations of flag states to ensure that vessels flying their flag do not violate international conservation and management measures [6]. After 2000, attempts to regulate IUU fishing became increasingly targeted. In 2001, the FAO published the International Plan of Action to Prevent, Deter, and Eliminate IUU Fishing (IPOA-IUU), which calls on respective states to "coordinate their activities and cooperate directly" [7] against IUU fishing. The Agreement on Port State Measures to Prevent, Deter, and Eliminate IUU Fishing (PSMA) [8] is regarded as the primary legal tool for governing IUU fishing. It is the first binding international instrument for governing IUU fishing, which was adopted in 2009 and enforced in 2016.

In recent years, according to the 2021 NOAA report, a growing number of countries are developing and enforcing regulatory measures in accordance with international standards and rules to regulate IUU fishing, where the contribution of developing countries has increased significantly [9]. However, due to the lack of commitment, input, and capacity, IUU fishing remains a significant challenge for global ocean governance and has to be further addressed through international cooperation [10].

Since the 1990s, the regulation of IUU fishing is a topic that has been widely studied when it first began to attract the attention of authors [11,12]. Subsequent studies have shown that IUU fishing has been found to be prevalent in small-scale fisheries all over the world and has significant negative effects on the biology, economy, and environment of the ocean [13]. The expected benefits from IUU fishing far exceed the expected cost, which has contributed to its rapid increase [14]. Current measures are insufficient to regulate IUU fishing [15,16] and, therefore, national and regional efforts needed to be strengthened [17,18] Although international legal instruments that regulate IUU fishing have been developed, IUU fishing has not been significantly decreased, which has stimulated discussions to explore more paths to address the issue in the last decade [19]. Regulation in a single region was deemed to be rarely effective on a global scale, and inconsistent enforcement in different areas makes it impossible to cut off the supply chain of IUU fishing [20,21]. Therefore, actors with various roles in the IUU fishing chain, in addition to the flag state as well as the coastal state, are being compelled to take on more responsibilities. Port states and potential market states are considered important regulators of IUU fishing activities to prevent the undetected diversion of IUU catch to destinations and international markets [22–24].

The legal aspects of IUU fishing have become a welcome topic, but the dilemma posed by the coupling of disputed maritime areas and IUU fishing has not received sufficient attention. It is argued that IUU fishing vessels usually operate in disputed waters, where enforcement is weak because the respective maritime enforcement agencies rarely patrol such areas [25]. In the disputed waters, fishing vessels engaging in IUU fishing activities are more likely to resist enforcement actions in a drastic manner. According to some authors, the overlapping jurisdiction of IUU fishing due to confrontational claims and the negative effects brought by such competition are emerging, and situations happening in the South China Sea and the Circumpolar Arctic are often mentioned [26,27]. In some cases, states are encouraged to take action to reduce the damage caused by IUU fishing until disputes in the respective waters are resolved, even though this may worsen the dispute [28]. So far, there has been no systematic analysis of the rights and obligations of respective state actors associated with IUU fishing activities in the disputed maritime areas. The states also seem

to be unclear about their respective obligations and potential responsibilities, which is one of the key reasons for the poor governance of IUU fishing in these areas.

Therefore, this study discusses the allocation of legal obligations to regulate IUU fishing in the disputed maritime areas and proposes a viable approach to address the IUU governance dilemma at present. Part II explains the serious threat posed by IUU fishing in the disputed waters and analyzes the reasons for the rapid increase in IUU fishing in the disputed maritime area and the difficulty of regulating them compared to non-disputed areas. Part III explores in detail the international law obligations and responsibilities of the states involved in the disputed maritime areas when taking different roles, particularly those that appear to be in conflict with each other. Part IV presents proposals to promote the cooperation among states in regulating IUU fishing in the disputed maritime area by strengthening and specifying legal obligations.

2. Lack of IUU Fishing Governance in the Disputed Maritime Areas

In general, a sea area in the absence of delimitation, where there are competing claims of sovereignty or sovereign rights of two or more states, is known as a disputed maritime area [29]. In this part, this study illustrates comprehensive hazards that resulted from the coupling of IUU fishing issues and disputed maritime areas and further discusses the causes of the complex situation.

2.1. Comprehensive Hazards of IUU Fishing in Disputed Maritime Areas

IUU fishing has proved to be harmful in several aspects, not only causing the degradation of natural resources and ecosystems but also threatening the livelihoods of fishermen in coastal areas and the economic growth of developing countries [30]. IUU fishing has more severe and complicated effects in the "disputed waters," which is alarming. Due to the lack of jurisdiction resulting from unclear attribution of maritime areas, IUU fishing activities may be less expensive and more prevalent in undisputed areas. Meanwhile, jurisdictional competition among the respective states may intensify disputes and lead to intense confrontations or even armed conflicts, which may undermine the peaceful atmosphere in the region. Moreover, IUU fishing is closely related to violations of human rights at sea due to the difficulty of enforcing the law in these areas.

2.1.1. Threatening Marine Ecology and the Authorized Fisheries

IUU fishing significantly damages marine ecology and violates the legitimate rights and interests of honest fishermen who engage in fishing activities under authorization. On the one hand, fish stocks continue to decline due, in large part, to unauthorized fishing activities, threatening the resilience of marine ecology as well as the global food security of human society [31]. According to a report released by China International Economic and Trade Arbitration Commission in April 2022, IUU fishing is statistically responsible for 20% of global catches, and, as a result, global economic losses range from 10 to 23.5 billion dollars per year [32]. In some disputed maritime areas, this negative impact of IUU fishing was found to be more pronounced. In the South China Sea, IUU fishing is considered to be one of the main reasons for the depletion of fishery resources and the deterioration of the ecological environment [33]. Both the quantity and quality of fishery resources in this area's traditional fishing grounds have shown a significant decrease compared to the mid-20th century. Since the 1950s, the total fish resources in the South China Sea have decreased by more than 70–95%, and the catch rate per unit has decreased by 66–75% [34]. The diminishing fishery resources in the South China Sea are also reflected in the fishing effort and catch rate of the coastal countries [35,36]. Similarly, the relationship between the presence of maritime boundary disputes and irrational IUU fishing activities has been identified in the Circumpolar Arctic [37].

On the other hand, IUU fishing is a serious threat to the economic interests and the food security of coastal areas, as well as to the livelihoods of fishermen in these countries. IUU fishing not only causes significant damage to fisheries and marine ecology but also indirectly

deprives countries of income from their fishing industries, in particular, damaging the economies of developing countries that depend on fisheries [22]. In addition, IUU fishing is extremely detrimental and discriminatory to those fishermen who act responsibly and honestly and in accordance with the terms of their fishing permits. If IUU fishermen target vulnerable stocks that are subject to strict management controls or moratoriums, efforts to rebuild these stocks to healthy levels will not be achieved, thus, threatening marine biodiversity and food security of communities that consume fisheries resources for major sources of protein [38]. Perhaps more worryingly, in disputed waters, a "honest" fisherman who work under one state's authorization could face IUU allegations from another state to the dispute, which will be discussed in detail later.

2.1.2. Increasing Tensions and Frictions in Disputed Maritime Areas

In addition to the direct negative impact of IUU fishing itself, the secondary harm caused by the issue in the disputed waters is equally serious. IUU fishing can quickly worsen maritime disputes, triggering accusations and tensions among parties to the dispute.

In the disputed waters, the boundary between IUU fishing and authorized fishing activities has been unclear in many cases. Due to the competing maritime claims in these areas, a fishing activity that is authorized by one party to the dispute or conducted in accordance with its domestic legislation may be defined as "IUU fishing" by other parties and, therefore, subject to penalties. For example, the conflict between Sri Lanka and India over traditional fishing rights in the Bay of Bengal has resulted in the arrest of fishermen and the confiscation of vessels from both countries. As of March 2016, Indian authorities claimed that the Sri Lanka Navy had seized 99 Indian fishermen and 83 vessels, some of which involved fishing activities that are, according to the Indian authorities, clearly legitimate and authorized [39].

In some cases, the claimant state also expresses its disapproval of the unilateral measures taken by a certain party in a more general manner, which results in constant arguments regarding the identification of IUU fishing activities. In the past few years, both Vietnam and the Philippines did not recognize China's fishing moratorium in the South China Sea and publicly claimed that China had "no right" to control their fishermen's activities in the respective areas. However, China is still enforcing its domestic laws for fishing vessels operating in such areas. Due to this, there have been numerous conflicts, frictions, and even more violent clashes involving vessels of the respective states [40,41]. In addition, even for an activity that is commonly referred to as IUU fishing, competing jurisdictions may present the problem that the claimant states may still accuse the one pursuing enforcement measures of violating their jurisdiction as the coastal state.

The jurisdictional differences of IUU fishing due to conflicting claims are likely to result in actions, confrontations, and even armed conflicts involving government vessels, worsening the situation in the disputed area. In a significant number of cases, the respective countries do not only express their views through verbal protests; they also send their own maritime police and naval vessels to "protect" their vessels or enforce operations. Clearly, such maritime encounters raise the possibility of conflicts and easily lead countries to adopt a more assertive stance due to domestic political considerations, creating a barrier to advancing peaceful settlement of the dispute [39].

2.1.3. Facilitating Organized Crimes

Currently, IUU fishing is listed as one of the top five environmental crimes identified by the EU, the G8, and the United Nations Environment Programme (UNEP). Indonesia also classifies IUU fishing alongside drug trafficking, piracy, and arms trafficking as a form of organized crime [42]. In 2020, the US Coast Guard asserted that IUU fishing had replaced piracy as the major threat to global maritime security. More worryingly, there is growing evidence linking IUU fishing to various crimes at sea and violations of human rights [39]. IUU fishing in disputed waters is extremely susceptible to developing into a haven for human rights abuses due to the lack of national jurisdiction.

It is found that IUU fishing in disputed areas can potentially trigger other organized crimes and violations of human rights at sea, such as forced labor, child labor, human trafficking, drug trafficking, wage garnishment, physical abuse, and debt bondage, among others [43]. For example, transnational crime often takes advantage of IUU fishing. Fishermen suffering from low wages and decreasing fish yields are often forced into the web of organized criminal activity in the IUU fishing industry, which includes tax crimes, money laundering, corruption, document fraud, and human, drug, and arms trafficking. In addition, large-scale IUU fishing activities build vast criminal networks to launder profits and traffic fish products to buyers and markets [44]. In a significant portion of the disputed area, the lack of state capacity to investigate, prevent, and address these human rights violations resulting from IUU fishing has significantly indulged in the commission of crimes.

2.2. Causes of the IUU Fishing Governance Dilemma in Disputed Maritime Areas

As has been discussed above, IUU fishing in disputed waters is becoming a major obstacle to the achievement of sustainable fisheries. The causes of the IUU fishing governance dilemma in disputed areas are more complex, which include obstacles to unilateral jurisdiction and cooperation measures due to disputes among respective parties. In addition, international legal rules were found to be ambiguous. Before beginning this part, this study does not focus on the factual issues of a specific dispute and, to the extent possible, does not evaluate the merits of the parties' maritime claims; instead, this paper focuses on the normative aspect of international law, although it acknowledges that there will inevitably be specific cases involved.

2.2.1. Difficulties in the Enforcement of Unilateral Jurisdiction

In general, coastal states are the main players in regulating IUU fishing activities in their own territorial seas and EEZs. They actively discourage and punish IUU fishing activities by third countries in the respective maritime areas to protect natural resource interests based on sovereignty or sovereign rights. The LOS Convention provides "exclusive" rights and obligations of the coastal state based on the requirement to give appropriate attention to the jurisdiction of the flag state. However, there are complex challenges to enforcing legislation or jurisdiction of coastal states in disputed maritime areas.

The parties to the dispute frequently adopt a cautious approach regarding the legislation and enforcement of IUU fishing activities to prevent escalating situations in respective areas. On the one hand, in several cases, geopolitical factors and inter-state relations have led disputants to avoid regional tensions in the disputed area. Each disputing party may legally assert jurisdiction over fishery resources and fishing activities in the area, which may be based on domain sovereignty, exclusive economic zone rights, or historical rights. Both legal fishing activities and IUU fishing are, in view of the disputing parties, subject to their own jurisdiction. Thus, once a party to a dispute has taken jurisdiction over what appears to itself to be a well-documented IUU fishing activity in the disputed areas, the other disputants are likely to view such action as an attack on their maritime interests and a challenge to their claims and, therefore, to strongly oppose it or even take countermeasures, as is the case of the Northern Territories [45] or the Natuna Regency [46]. The disputants will be prevented from taking unilateral measures to regulate IUU fishing as a result of the potential pressure to escalate tensions. On the other hand, the lack of jurisdiction in the disputed area encourages vessels from disputing states or other states to engage in reckless IUU fishing because they understand that there is a jurisdictional gap. In the case of third-state vessels, the disputants may avoid having jurisdiction over these vessels whenever possible because they tend to avoid upsetting third parties and pushing them to the side of their "rivals". In addition, the symbolic significance of fishing activities in the disputed area has encouraged IUU fishing activities. Fishing in disputed areas is often given a "political dimension": for several disputants, fishing in disputed areas is an important way of demonstrating the "legitimacy" of rights and effective control of maritime areas.

Therefore, some countries often provide lenient incentives to encourage their fishermen to fish in the disputed area instead of enforcing strict fishing standards and regulations [47]. At the same time, they impose blanket bans or stringent standards on the activities of fishermen from other countries. This has resulted in a lack of coordination of the jurisdictions among the respective states and a perpetual state of confrontation and offsetting, which has greatly reduced the effectiveness of the measures and made it difficult to impose sufficient constraints on IUU fishing activities.

2.2.2. Cooperative Governance Measures Hindered

According to some studies, coastal state jurisdiction in undefined maritime zones heavily relies on the agreement and tacit consent among the parties to a dispute and between the parties to a dispute and a third state, i.e., the flag state [48]. However, in several disputed areas, such cooperative governance measures, in particular, multilateral ones, are challenging to accept and even more challenging to effectively enforce due to the conflicting political interests of states. In the South China Sea, multilateral measures are essential to regulate IUU fishing activities due to the prevalence of multiple disputants in the same area and the interconnected nature of the areas in which fishermen from different countries operate. However, there is not yet a fisheries cooperation agreement in the South China Sea in which all countries in the region participate. Most of the neighboring countries manage their fisheries cooperation through bilateral agreements, but bilateral agreements can hardly meet the needs for sustainable development of fisheries in the South China Sea. In fact, a number of bilateral agreements have been concluded between China, Vietnam, Indonesia and the Philippines since 2000. For example, China and Vietnam have made detailed arrangements for fisheries development and protection in the demarcated areas of the Beibu Gulf/Gulf of Tonkin, requiring both sides to cooperate in monitoring and promptly informing each other of the situation in the common fishing area. However, few bilateral agreements attempt to include fisheries management arrangements concerning the disputed area because of the political sensitivity of the topic as well as potential oppositions from third parties [49].

At the same time, the South China Sea region has not yet developed a multilateral fisheries organization with credibility and enforcement power, nor has it established full monitoring, control, and surveillance measures: the geographical scope of the current cooperation measures is either too broad and involves complex subjects, in which their actual operation often contradicts the ideas of the countries surrounding the South China Sea, or too narrow to regulate the entire South China Sea waters as a whole. These organizations such as Asia-Pacific Fishery Commission and Southeast Asian Fisheries Development Center perform a variety of tasks, each of which demonstrates fragmentation, a lack of communication and coordination, and is often administrative, consultative, or technical in nature, with only advisory and suggestion responsibilities [50].

Deep within this dysfunctional cooperative governance measure for IUU fishing, this study identifies the underlying causes that influence the choices of states in various ways: first, the parties to a dispute may fear that they won't be able to lead the cooperative governance process and, instead, will need to give "consent" to the other party enforcing jurisdictional measures in the disputed area, thereby, "legitimizing" the action in question, recognizing the other state's sovereignty and creating uncertainty about its own sovereignty claim [51]. In general, such agreements and measures will, to some extent, likely strengthen the *de facto* control of the other state over the disputed area.

Second, cooperative governance of disputed areas requires a compromise among the parties, but the rise of nationalism on a global scale makes it difficult for disputing governments to adopt a compromising cooperative stance [52]. Territorial and maritime disputes have long been a common issue used by politicians in various countries to stir up nationalist sentiments, and several minor conflicts have been unresolved because of such sentiments, eventually growing into a regional "security issue." It is difficult for governments involved in the dispute to avoid domestic nationalist sentiment and, thus,

they tend to refuse to compromise when dealing with disputes, yet mutual compromise is the essential factor to achieve cooperation [53].

Last, for their own fisheries or geopolitical interests, countries with no or weak claims to the disputed area often take a position of non-cooperation or even hinder the cooperation of the respective parties, which hinders the formation and operation of multilateral measures [48]. The impact of U.S. intervention in the South China Sea on relevant domestic cooperation mechanisms is a good example [54].

2.2.3. Limitations of International Legal Rules

Examing international legal documents regarding the regulation of IUU fishing, the rules governing disputed areas are considered to be rather unclear. The LOS Convention, commonly referred to as the "Constitution of the Oceans", prescribes that the coastal state be given exclusive rights and obligations to regulate IUU fishing and provides rules governing the temporary delimitation of the exclusive economic zone, assuming that states should seek peaceful solutions to avoid escalating tensions, and develops a complex dispute settlement measure for the disputing parties [55]. However, such provisions are too vague with no operational and concrete measures: Is it an aggravation of a dispute for a state to regulate IUU fishing when one or more parties to the dispute are not involved?

In addition, the LOS Convention does not provide rules governing the settlement of the territorial sovereignty dispute. However, several disputed maritime areas result from disagreements among the respective states over islands or mainland territories (e.g., Northern Cyprus, Black Sea), the so-called territorial–maritime disputes [56]. The logical sequence of the two is well illustrated in China's opposition to the South China Sea arbitration, though the tribunal does not appear to have accepted this view, which has led to China's "Three Don't" policy [57]. In addition, the dispute is not resolved by choosing maritime zones without considering the question of sovereignty. Other international laws outside of the LOS Convention are almost silent on such a difficult subject as disputed maritime areas and contribute little to help resolve the issue.

In this context, it is unclear what legal status the parties involved in the disputed area have to regulate IUU fishing, which even puts the states actively enforcing regulations at risk of violating international law. Coastal states (or potential coastal states) in the disputed area often address the issue of IUU fishing with the perception that they lack a clear legal basis for jurisdiction because the area in question has not yet been fully established. Therefore, they are reluctant to enact and enforce domestic legislation to avoid "violating" the LOS Convention and general international law. States' uncertainty about the legitimacy of their own and each other's authority, as well as the disputes that arise in practice, is one of the main causes of the hesitation to regulate IUU fishing in the disputed area. This study will further discuss this issue in the next paragraphs.

3. Obligations of States to Regulate IUU Fishing in Disputed Maritime Areas

Under the current regime of international law, flag states, coastal states, port states, and market states all have respective legal obligations regarding IUU fishing activities and may incur state responsibility for their breaches. It should be noted (but is often overlooked) that the existence of a dispute in the respective maritime area rarely lessens the obligations of the respective state or exempts it from any responsibilities. Therefore, the rules governing the regulation of IUU fishing activities in disputed sea areas are different from those in other sea areas. However, this cannot be a valid justification for the respective states to engage in IUU fishing but should be taken as a driving force and opportunity for cooperation in IUU fishing in the disputed area.

3.1. Obligations and Responsibilities of the "Coastal State"

According to Article 56.1 of the LOS Convention, "in the exclusive economic zone, the coastal state has sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources … " As the other side of such rights, the coastal

state shall, taking into account the best scientific evidence available to it, ensure through proper conservation and management measures to maintain the living resources in the exclusive economic zone from over-exploitation and cooperate with "competent international organizations, whether sub-regional, regional, or global, to this end." In addition, the sovereign rights and jurisdiction of the coastal state are subject to other provisions of the LOS Convention, such as marine environmental protection and conservation. Therefore, coastal states are required, under Article 192-193, to fulfill "the obligation to protect and preserve the marine environment" within the territorial sea, exclusive economic zone, and high seas and properly regulate IUU fishing.

The draft articles on the responsibility of states for Internationally Wrongful Acts provide that "[t]here is an internationally wrongful act of a state when conduct consisting of an action or omission: (a) is attributable to the state under international law; and (a) is attributable to the state under international law; and (b) constitutes a breach of an international obligation of the state" [58]. It is clear that in non-disputed territorial seas or EEZs, coastal states have an obligation under international law to regulate disproportionate damage to marine ecology and resources, such as IUU fishing activities, and this obligation is recognized by the international community and established by international treaties. A breach of such an obligation would constitute an internationally wrongful act, which would entail state responsibility. The question is, what are the implications for the obligations and potential responsibilities of coastal states in the event of a dispute in the maritime area? Some may suggest that there may be no legally established coastal state in the disputed area that can assume such obligations or clarify the implications for potential state responsibility of the lack of physical control by the respective state over part of the disputed area. Therefore, it is necessary to have a categorization of the discussion to address more complex situations in the disputed maritime area.

3.1.1. Disputed Maritime Areas Resulting from Disputes over Territorial Sovereignty

First, given the exclusivity of sovereignty, when we refer to a specific piece of land after World War II, whether it is a coastal part of the mainland or an island, we typically assume that it is occupied by a sovereign rather than being a piece of terra nullius [59]. For this reason, the regime of terra nullius is considered, at least on the land surface of the earth, almost extinct under contemporary international law regimes [60]. In fact, this conclusion supports a presumption that is often overlooked: the territory in dispute has its "true" sovereignty, although sometimes this fact may appear less clear for one reason or another. In other words, without taking into account the need for further delimitation with other states, there must be a party to the territorial sovereignty dispute that is the proper "coastal state" for the disputed maritime area in question, which is generated from this disputed territory.

For example, suppose there is a territorial dispute between State A and State B, and State A is eventually legally considered to have sovereignty over this territory through an international adjudication or any other method. This also means that State A has been, since the beginning of the dispute, the coastal state in the potential maritime area from which this territory arises. In this context, the failure of State A to properly regulate IUU fisheries in the area during the dispute can then be divided into two categories based on the facts: The first case is that State A was capable of enforcing appropriate or certain regulation measures during the period in dispute but failed to do so. This "capability" should be judged not only by the exhaustion of feasible unilateral measures but also by whether it has exercised its best efforts to cooperate with the other party to the dispute; otherwise, the conduct of the state would still fall within the scope of "omission" under the draft articles on state responsibility [61]. The other case is that State A had exhausted all measures to regulate IUU fishing in the area in question during the dispute but had failed to do so due to a lack of physical control and lack of cooperation from the other party. In these contexts, this conduct of omission cannot be "attributable to the state under international law" when deciding whether it constitutes a wrongful act. Even taking into

account the possible argument that such causation is considered to be *de facto* causation, State A is relieved of international responsibility for such an "internationally wrongful act" in accordance with the rule of *force majeure* [62].

The next question is, does the other party have the obligations and bear potential responsibilities under international law to regulate IUU fishing in the disputed maritime area? The answer to this question is not limited to the LOS Convention or other laws of the sea; the laws of war also provide some insights. Prior to anything else, the legal status of State B in the dispute should be considered: if State B is merely a claimant state and does not occupy the disputed territory and control the respective maritime area, it does not have any position as the "coastal state." The situation is quite different if State B has control over the disputed islands and, through the military or administrative projection of power, truly has control over the maritime area to a distance of 12 nautical miles or even further. Under the laws of war or international humanitarian law as it is now more commonly called, State B becomes *de facto* the occupying power of the disputed islands. Furthermore, according to Geneva Protocol IV, this law may also apply to areas of the territorial sea that the occupying power already has control over or where there are no obstacles to its control. Because State B is the occupying power, it not only has the legal authority to enforce the law and maintain order in the occupied area, but it also has a responsibility to do so. In this context, the obligation to properly manage and conserve fishery resources within the territorial sea would be included, as it is widely accepted as a treaty obligation and is respected as a customary obligation [63].

The above conclusion may not raise too much dissent. However, can State B achieve a status similar to that of an occupying power in the EEZ based on its occupation of islands and physical control of respective maritime areas? The answer is yes. In disputes, such as those over Northern Cyprus, the South China Sea, and the Malaysian Island, the state in control of the territory often makes a request for the delimitation of the EEZ and the continental shelf (although, of course, the state without physical control does not hesitate to ask for such request) and legislates and enforces the law within the EEZ (presumed sometimes) in order to have the advantage of natural resources [64,65].

If State B is ultimately found to occupy these territories and territorial seas, the basic principle of "congruence of rights and obligations" states that even though it is unclear whether the law of war or the law of the sea is applicable, it is reasonable to assume that State B should assume its obligations as the *de facto* administrator or controller of the disputed maritime area, which includes the degree that it is physically competent to do so, to regulate IUU fishing activities. Otherwise, State B (occupier) would enjoy a more privileged position than State A (coastal state) in terms of managing and exploiting natural resources (which they could argue for the vitality and well-being of the inhabitants of the occupied area) without the corresponding obligations. In other words, State B should assume the obligation to regulate IUU fishing in the areas in which it believes it has sovereign rights and jurisdiction, subject to its ability to exert effective control.

In summary, whether one of the parties to the dispute is ultimately regarded as a "coastal state" or an "occupying state," their actual obligations and potential responsibilities regarding the regulation of IUU fishing are not suspended simply because a dispute exists but, instead, are consistent with their actual control. In other words, the obligation to regulate IUU fishing in a specific maritime area should not be assumed to have been suspended simply because a dispute exists.

3.1.2. Disputed Maritime Areas Not Resulting from a Territorial Sovereignty Dispute

In general, maritime areas beyond the territory and territorial sea cannot be occupied. In addition, the enforcement of the law of occupation outside the national domain alone is even more controversial when the territory and territorial sea are not occupied [63]. Therefore, the law of occupation is no longer the appropriate law in maritime delimitation disputes, as opposed to cases involving both territorial and maritime issues. However, this does not mean that the parties to a dispute in a disputed maritime area that is not the result

of a territorial sovereignty dispute are completely free from all coastal state obligations to regulate IUU fishing activities. Until the maritime delimitation is complete, the LOS Convention requires the respective states to "in a spirit of understanding and cooperation . . . make every effort to enter into provisional arrangements of a practical nature," which imposes an international law obligation on the states to cooperate in achieving the governance of IUU fishing in the disputed area.

At the same time, the rule of "congruence of rights and obligations" can also be applied in this case because authorizing and managing fishing activities in the disputed area as a "coastal state" indicate an obligation on the part of the "coastal state" to protect ecological and maritime resources and conserve the obligation. In addition, if the party decides to take action to stop IUU fishing in the disputed area, they should do so without bias and not just against the other party. Otherwise, according to the LOS Convention Article 73, this could result in the use of unilateral measures to escalate the situation and, therefore, constitute a breach of the obligation to not "jeopardize or hamper the reaching of the final agreement." If these unspecified obligations are considered too crude and vague, the flag state status of the respective state must provide a clearer perspective on the issue.

3.2. Obligations and Responsibilities as a Flag State

The flag state is the state whose flag a vessel flies when fishing at sea, and "vessel" refers to fishing vessels and vessels that assist in fishing activities, such as transport vessels, which receive the catch from fishing vessels, and supply vessels, which provide fuel and food to fishing vessels. Due to the depletion of offshore fishery resources, fisheries in the distant seas, EEZs, and high seas—where the jurisdiction of coastal states is limited to varying degrees and cannot effectively regulate IUU fishing—have become the primary source of catch. In this context, the flag state is assumed to have primary responsibility for the regulation of IUU fishing activities. National regulation of IUU fishing continues to rely primarily on flag states' actions [66].

Article 94 of the LOS Convention states that "every state shall effectively exercise its jurisdiction and control in administrative, technical, and social matters over ships flying its flag." This provision also sets out obligations regarding the proper registration, establishment, and enforcement of national law for ships and seafarers in relation to administrative, technical and social matters, safety matters, etc. According to the Fisheries Jurisdiction Advisory Case, the LOS Convention requires flag states to exercise diligence in preventing IUU fishing activities within and beyond areas of national jurisdiction [67]. Flag states shall adopt domestic fisheries laws and, as a result of their jurisdiction, enforce regulatory measures against their fishing vessels wherever those vessels operate, even though these jurisdictions are subject to national sovereignty in the territorial sea and observe the jurisdiction of the coastal state in the exclusive economic zone.

Following the conclusion of the LOS Convention, although not legally binding, the Code of Conduct for Responsible Fisheries and the IPOA-IUU present a more concrete picture of the obligations of flag states to regulate IUU fishing activities by their vessels. IPOA-IUU states that "states should embrace measures building on the primary responsibility of the flag state and using all available jurisdiction in accordance with international law . . . to ensure that nationals do not support or engage in IUU fishing . . . use all these measures, where appropriate, and to cooperate . . . " In addition, it states that "[a] flag state should ensure, before it registers a fishing vessel, that it can exercise its responsibility to ensure that the vessel does not engage in IUU fishing" [68]. This has led to flag states being encouraged to review the history and status of registered vessels to determine their use and to keep records to track their careers by themselves and other states. In particular, in terms of domestic legislation and enforcement, flag states are encouraged to ensure that vessels flying their flag are legally engaged in fishing activities by tightening the issuance of fishing licenses and enforcing real-time monitoring measures, such as vessel monitoring systems, catch monitoring systems, and onboard observers.

The Code of Conduct for Responsible Fisheries is more detailed in terms of enforcement measures. It states that flag states should take enforcement measures against fishing vessels entitled to fly their flag that they find are not following the respective conservation and management measures, including, where necessary, treating breaches of such measures as breaches of national law. Sanctions for such violations should be sufficiently severe to ensure compliance, prevent any violations from reoccurring, and deny offenders the benefits of their illegal activities, which include provisions for refusal to issue, suspend, and withdraw fishing licenses [67].

Within the disputed maritime area, whether it is the territorial sea or the EEZ, no additional regulations that diminish this important power to regulate IUU fishing under international law exist and certainly do not deny them of the responsibilities that may arise. However, if fishing activity occurs in the disputed EEZ, it must be decided whose laws should be followed and which flag state should be asked for cooperation.

Assuming that the flag state is a party to the dispute, it may consider itself a coastal state in the EEZ and allow its vessels to violate the EEZ legislation enacted by the other party (competitor) or even encourage such violations because such legislation is probably not binding at all from their perspective. This situation is equally confusing, assuming that the flag state is not a party to any of the disputes. In this context, the flag state may well be faced with two different sets of legal rules. Its vessels' activities may be identified as IUU fishing by one party while they comply with the rules of the other and may sometimes be at risk of duplication of enforcement and penalties. However, in any event, the flag states' obligation to regulate IUU fishing by its vessels and to cooperate with the coastal state is not abrogated by the existence of a dispute in the respective sea area. Therefore, how this obligation can be truly and effectively enforced in good faith to avoid state responsibility requires proper coordination between the disputing parties and third states.

3.3. Obligations and Responsibilities as a Port State or Market State

In recent decades, Port state measures have been considered an important aspect of ocean governance, and a large number of international legal documents outline the obligations and responsibilities of flag states. As early as 1982, in Part XII of the Convention on the Protection and Preservation of the Marine Environment, regarding marine pollution, Article 218 outlines the conditions for port states to initiate judicial proceedings, cooperate with flag states, and enforce measures such as investigating records. Since then, the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas, the Code of Conduct for Responsible Fisheries, the United Nations Fish Stocks Agreement, and IPOA-IUU have all mentioned port state regulation of IUU fishing-related fisheries [69]. Building on this, the PSMA, which was enforced in 2016, marked the development of IUU fishing from a voluntary technical standard to a legally binding international legal term [70].

In particular, port states are obliged to prevent vessels engaging in IUU fishing from entering and using the country's ports and develop measures to achieve this objective. Prior to entry, if a vessel is on the list of IUU vessels, port states shall refuse it using their ports unless other respective measures are taken. Upon entry, the port state has the right to inspect whether the incoming vessel is associated with IUU fishing activities, verify the information requested on the application for entry, and confirm whether the vessel applying for entry is engaged in IUU fishing activities in order to determine whether to permit or deny the vessel access to its designated port. After inspection, a port state shall deny entry to a vessel if it has solid evidence that the vessel has engaged in IUU fishing or related activities. The PSMA also requires port states to diligently cooperate with international organizations, which include flag states, regional fisheries organizations, and FAO, in the communication of information and regulatory measures for IUU fishing. Particular port states that those who violate the PSMA regulations will be not only morally accountable but also subject to immediate national liability.

In addition to the obligatory requirements for port states, supply chain governance has led international organizations and countries to consider the potential and role of market states in regulating IUU fishing. Although no legally binding treaty has been adopted, international legal documents, such as IPOA-IUU, have proposed some recommended standards and regulations for market-related measures. According to IPOA-IUU, "states should take all steps necessary, consistent with international law, to prevent fish caught by vessels identified by the respective regional fisheries management organization to have been engaged in IUU fishing being traded or imported into their territories".

However, these measures are subject to trade regulations, such as those established by the World Trade Organization, and require the necessary consultations with the respective countries to prevent overly aggressive and biased controls that undermine a fair trading order. According to IPOA-IUU, such controls would cover the entire flow of the catching trade, which includes imports, logistics, banking, and insurance, in addition to the fishing industry. However, currently, this is considered a relatively difficult task for some governments. In addition, port states and market states will face the dilemma regarding identifying IUU fishing, especially when parties to the dispute enforce different or contradicting standards; in this case, multilateral cooperation measures and international organizations should play their role.

4. Pathways for Strengthening IUU Fishing Governance in Disputed Maritime Areas

As the need to balance human productive life with natural ecology has become more widely recognized by the international community, nature-based solutions have started to be considered the basis for addressing challenges at sea [71]. The parties to the dispute, as well as extraterritorial states, should consider nature-based solutions to disputed waters a necessary guideline. Disputes among states should not be a driver for the proliferation and lack of regulation of IUU fishing; instead, states should collaborate to identify priority objectives and enforce solutions to the marine ecological crisis with nature truly at the core. In addition, this emphasis on the obligation of each party to regulate IUU fishing won't prevent disputes from being resolved or escalate regional situations. However, such obligations are likely to play a significant role in encouraging cooperation and consensus among the respective states, overcoming domestic resistance including pressure from caused by nationalism, and helping to ease the atmosphere in the disputed area, as well as promoting a peaceful and final settlement of the dispute.

4.1. Cooperation as a Necessary Means of Fulfilling Obligations

As has been discussed above, in most circumstances, the existence of a dispute in the maritime area does not alter the obligations of the states involved in the dispute of extraterritorial states to regulate IUU fishing in the area, whether based on the legal status of coastal states, flag states, or port and market states. Although there are special circumstances in the disputed area where a "coastal state" in international law may not be explicitly identified at some point, this does not derogate the obligations of the claimant or non-claimant state to take legislation and enforcement measures to regulate IUU fishing.

In other words, states claiming disputed maritime areas potentially have obligations to regulate those areas subject to the actual situation. The state to which the disputed area is ultimately attributed under international law will always have an obligation to regulate IUU fishing in that area for the duration of the dispute; however, a breach of this obligation may not result in either international responsibility or responsibility exemption, assuming that there is no possibility for the coastal state to fulfill its obligations. For states that control these maritime areas but are eventually found to lack qualified entitlement, their obligations are similar to those of the occupying state in terms of territory and territorial sea. Failure to regulate IUU fishing activities due to inaction would result in responsibilities relating to marine ecological protection based on the LOS Convention and general international law.

In addition, for the flag, port, and market state in the disputed area, the existence of a dispute over the area in question has little to do with the obligations placed on

them. The absence of delimitation would not constitute a reason to exempt it from its obligations. The problem is that some states may improperly use such disputes to increase their national interests regarding the fishing industry or even promote IUU fishing through their own vessels and enterprises [49], which violates international law and contradicts their obligations.

Having established the rights and obligations of the respective parties regarding IUU fishing activities, the specific content of such obligations, or rather as a facet of the obligation of conduct, should be further considered. The obligation of the parties in the disputed area to prevent the escalation of the dispute under international law has been repeatedly addressed in international adjudications, including the recent Ukraine v. Russia order for preliminary measures [72].

However, what measures can be considered to "aggravate or extend the current dispute or render it more difficult to resolve" are often determined on a case-by-case basis. In such cases, legislation and actions by the disputing state to regulate IUU fishing may be seen as a breach of that obligation. Such regulatory measures are perceived by the counterpart state as a challenge to its claims; thus, such unilateral jurisdiction is criticized for endangering regional peace and order even though it would require drastic confrontational measures. This makes it extremely difficult, if not impossible, to fulfill the obligation to regulate IUU fishing through unilateral measures. Therefore, in order to balance the obligation to prevent the escalation of the dispute with the obligation regarding IUU fishing, the parties to the dispute have no choice but to cooperate in the respective region until IUU fishing is properly regulated. Therefore, cooperation in the regulation of IUU fishing in the disputed area has become part of the specific content of the marine ecological protection obligation; thus, states must act to facilitate cooperation to the extent possible, although this does not necessarily require them to make concessions on the dispute.

4.2. Setting Aside Dispute and Pursuing Cooperative Governance

First, IUU fishing in the disputed maritime area may not only complicate the dispute and worsen the regional status quo but also reduce tension among the parties and promote the peaceful settlement of the dispute. In particular, due to the parties' obligations regarding IUU fishing, all states are on the brink of failing to fulfill their obligations and, therefore, taking state responsibility. This shared legal risk creates some space for the parties to make compromises on the issue. States must cooperate to fulfill their international law obligations to regulate IUU fishing in the disputed area. At the same time, these obligations from international law can also be a lever for politicians to overcome domestic political resistance and populist challenges. Acting in accordance with international law is a good justification for controlling such irrational and peace-breaking actions. Therefore, it is necessary for governments to shift their understanding of each other's control over IUU fishing in disputed waters and promote the peaceful settlement of disputes with "functional cooperation," which has nothing to do with their territorial or maritime claims.

Second, the parties should set aside their disputes and shift their focus to the protection and conservation of marine ecology and fishery resources. When cooperation is considered a necessary means of meeting obligations to regulate IUU fishing activities, it is reasonable for states to set aside disputes and move toward full cooperation in disputed areas. One of the well-known advocates of setting aside disputes and pursuing joint development is China [73]. China has maintained a position on hydrocarbons in the South and East China Seas, where potentially interested states have jointly developed hydrocarbons without engaging in discussions about sovereignty and the ownership of maritime areas. This path blurs the contradictions among the acrimonious sovereigns and, instead, attempts to functionally realize the expectations of the respective parties regarding the interests of the regions involved [74]. On the issue of governance of IUU fishing, states have a common interest and shared international law obligations to regulate IUU fishing activities in order to avoid loss of natural resource benefits and potential responsibility. Therefore, the best

course of action that serves the interests of all parties would be to set aside the dispute and cooperate on the governance of IUU fishing.

Last, allowing another state to legislate or take enforcement measures does not and should not be seen as a derogation from the sovereignty, sovereign rights, or jurisdictional claims of any party. From an ethical point of view, although marine ecology should be the main focus of the issue, it is important to note that for sovereigns, territory and maritime areas are often considered as their most important and inalienable interests. At most times, cooperation in the governance of IUU fishing activities is only likely to be acceptable if it does not compromise such a "core interest". Therefore, states should agree that allowing each other's regulation of IUU fishing in the disputed area can neither be seen legally as a reinforcement of effective regulations nor as any change to the status quo. In other words, the regulation of IUU fishing should only be considered a fact and not be given any legal or evidentiary effect by the parties, third parties, or international organizations; otherwise, it would significantly diminish the potential for states to cooperate in the governance of IUU fishing.

4.3. Facilitating the Coordination of Measures of the Parties

What standards and regulations governing IUU fishing activities should be applied in the disputed area is an important and potentially confusing matter for both the disputing states and other parties. On the one hand, the LOS Convention Article 56 states that the coastal state has sovereign rights over the conservation and regulation of natural resources within the EEZ and jurisdiction over the "protection and preservation of the marine environment". This means that coastal states have the right to establish regulations and standards to regulate IUU fishing; however, they "shall have due regard to the rights and duties of other states and shall act in a manner compatible with the provisions of this Convention". These regulations and standards will be an important basis for flag, port, and market states in determining the legality of the fishing activity. However, in the disputed maritime area, there is a high risk of the absence of or, in contrast, duplicate legislation of the coastal state.

In the former case, in addition to encouraging the parties to the disputed area to cooperate in fulfilling their obligations to regulate IUU fishing, flag state legislation and enforcement will be an important and determining factor in regulating IUU fishing in the disputed area. Until coastal states fulfill their obligations, flag states should be encouraged to develop regulations and standards, which should be respected by the respective states.

The latter scenario case resulted in more confusion. Two different standards would make it difficult for the flag state to have due regard to the coastal state and comply with the laws and regulations adopted by the coastal state. International law or other international laws do not give a meaningful answer to this situation. For third-party states, a possible way of dealing with the situation would be to follow the legislation of the state that actually controls the maritime zone; however, compliance with either regulation should be considered to satisfy the requirements of international law for third-party states since it is impossible to require them to choose between these two different regulations and criteria as to which is the legislation of the legally eligible coastal state. Of course, the ultimate resolution of this issue still depends on the cooperation of all respective parties.

On the other hand, the regulation of third-party fishing activities by the parties to the dispute raises some concerns. In the undefined part of the Japan–Korea EEZ, the parties have not yet reached sufficient consensus on how to regulate IUU fishing activities by third-party vessels. In order to address this issue, additional bilateral and multi-party negotiations need to be considered as the next step to be taken. In this regard, the establishment of a joint fisheries committee through a binding agreement may be a helpful way forward. A good example is that China and South Korea have effectively achieved fisheries governance in maritime areas pending delimitation through continuous and timely cooperation under the joint fisheries commission. In addition, strengthening regulatory cooperation among the parties in the disputed area, including the joint establishment of provisional

regulations and standards, institutionalized communication channels, and proper dispute settlement measures, is the only option to effectively regulate IUU fishing.

4.4. Enhancing Multilateral Governance Mechanisms

In disputed areas, in addition to the disputing parties, the non-party states are also an important part of the chain in addressing the increase of IUU fishing activities, as they serve as a flag state, port state, and market state, being responsible for regulating IUU fishing. Only if all parties involved take responsibility can the ecology of the disputed area be saved from the risk of depletion caused by over-exploitation. In response to the alarming issue regarding IUU fishing in the disputed area, in addition to the need for the parties to change their unilateral management model and actively seek institutionalized cooperation among the parties to strengthen regulatory legislation and enforcement, "extraterritorial states," although in some cases pose additional risk in settling the dispute, should also be considered [75]. In other words, it would be unreasonable and irresponsible to exclude states other than those parties to the dispute in terms of the governance of IUU fishing.

In terms of "setting aside dispute and pursuing cooperative governance", the respective states should establish a targeted regional fisheries cooperation measure with third-party countries by signing a multilateral agreement in accordance with the LOS Convention and other international laws already concluded, general legal principles, and a nature-centered philosophy. States should clarify the obligations and potential responsibilities of each party, cooperate in the development and regulation of fishery resources, conduct joint investigation and maintenance of fishery resources in disputed waters, and promote effective regulation of IUU fishing practices. In particular, there are several instances where states can effectively work together.

First, states should jointly examine regional fishery resources and monitor their activities. The objective of such cooperation is to enhance transparency and the science of fishery management and provide a recognized and sound basis for the development of regulations and enforcement of measures. The exclusion of certain respective states, or closed information-sharing measures, should be carefully considered in this matter.

Second, states should work together to develop regulations to regulate IUU fishing in disputed maritime areas. However, this does not mean that the respective states must give up their claims to the territory and maritime zones, nor does it represent a readjustment of the balance of interests and jurisdictional regulations under the LOS Convention. The sole purpose of such cooperation should be to seek a realistic solution to the proliferation of IUU fishing in the disputed area by setting aside disputes and reaffirming the obligations of states based on their respective status.

Third, in order to enforce the regulations governing IUU fishing, the parties should consider the importance of the provisional arrangement of jurisdictional areas and respect each other's enforcement measures under the consensus already in place. Likewise, the flag state should fully understand that its obligations in relation to regulating vessels flying its flag in the disputed maritime area should be more carefully enforced. This may imply a lesser obligation of "due regard" to the coastal state, given the practical difficulties and more diligent enforcement of ecological protection, conservation, and preservation obligations [76,77].

Lastly, different and conflicting jurisdictions of the parties should be taken into consideration in advance. States are encouraged to make use of the wealth of dispute settlement measures in accordance with the LOS Convention or consensual procedures to peacefully resolve disputes and, to the extent possible, prevent the use of unilateral measures, in particular, radical actions that could escalate the situation in the region.

5. Conclusions

According to some authors, the governance of IUU fishing in disputed maritime areas has not received sufficient attention from states or researchers because (1) fisheries lawyers usually consider only the fisheries law and (2) delimitation specialists only focus more on

the impacts of maritime characteristics and the developing delimitation methodologies [78]. In fact, increasing IUU fishing in the disputed waters has caused significant damage to marine ecology and fishery resources and harmed the livelihoods of honest fishermen. These activities also cause secondary damage, which includes increasing the risk of escalating the situation in the respective maritime areas and encouraging violations of human rights at sea. This study found that the lack of governance of IUU fishing in the disputed maritime area arises because unilateral measures face challenges from other disputants as well as extraterritorial states and the disputing parties are concerned that cooperative governance will weaken their control in the respective area or even constitute acquiescence to the jurisdiction of other states. The current international legal documents contain too much uncertainty as far as these issues are concerned.

However, a review of the current international legal documents shows that the LOS Convention, fisheries agreements, and customary international law have created a range of international legal obligations for states in various contexts and that the existence of a dispute in a specific area does not normally result in a derogation from these obligations or an exemption from potential responsibilities. First, the claimant states in the disputed maritime area, whether or not they are ultimately found to be legally competent coastal states, may bear the obligation as the coastal state to regulate IUU fishing, although the extent of that obligation and the potential state responsibility depends on a number of factors, such as the actual situation, capacity to control, and their conducts. Second, the obligations of flag states regarding IUU fishing are, for the most part, unaffected by disputes, but this can result in some challenges when they are considering the relationship between the flag state and coastal state jurisdiction. Third, port and market states also have obligations, in particular, treaty-based obligations, to address IUU fishing in the disputed area, where they may face some issues due to a lack of legislation or duplication of legislation.

In order to strengthen the governance of IUU fishing in disputed waters, a number of functional methods should be adopted to address the obstacles that result from inter-state disputes and to promote ecological conservation. Regional and cross-regional cooperation should be considered as a necessary method for states to fulfill their obligations to regulate IUU fishing and to avoid the state responsibility resulting from "omission". Parties to the dispute are encouraged to set aside their disputes and cooperate in the regulation of IUU fishing activities. In addition, it is necessary to include "extraterritorial states" in the cooperative measure to achieve proper coordination of legislative and enforcement measures and to promote the institutionalization of the governance of IUU fishing. In conclusion, the obligations of states under international law to regulate IUU fishing will, in most scenarios, not be derogated because of the existence of the dispute, and these obligations, while enhancing cooperation among states to address the governance deficit in IUU fishing, are likely to reduce the tensions in the disputed region and further promote a peaceful resolution of the dispute.

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Perspective

A Sustainable Approach towards Fisheries Management: Incorporating the High-Seas Fisheries Issues into the BBNJ Agreement

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Abstract: The issue of high-seas fisheries is the main threat to biodiversity in areas beyond national jurisdiction. The BBNJ Agreement, which focuses on biodiversity in areas beyond national jurisdiction, is under vigorous discussion. Subject to the "not undermine" requirement and considerations of practical interests, it is highly possible that the BBNJ Agreement may not address the issue of fisheries on the high seas. The objective of this paper is to analyze the relationship between the high-seas fisheries issue and the BBNJ Agreement for the purposes of the conservation of marine biodiversity, the unity of the marine ecosystem, and the consistency of regulations. It maintains that from the perspective of protecting the oceans, enacting legislation in areas beyond national jurisdiction, and transforming marine management mode, the issue of high-seas fisheries should be included in the BBNJ Agreement. In the future, the BBNJ agreement needs to clarify its scope of application, resolve overlapping issues through general regulations and conflict rules, clarify the methods and contents of international cooperation, and establish international law obligations for integrated ocean management.

Keywords: areas beyond national jurisdiction; marine biodiversity; not undermine; high-seas fisheries; BBNJ agreement

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1. Introduction

Biodiversity issues beyond areas of national jurisdiction are under unprecedented pressure, among them, high-seas fisheries have been a major threat to biodiversity in areas beyond national jurisdiction [1]. The United Nations Agreement on the Conservation and Sustainable Use of Marine Biological Diversity of Areas beyond National Jurisdiction (the "BBNJ Agreement"), aims to design a set of methods such as zoning management tools and environmental impact assessments to protect marine biodiversity and regulate human activities to utilize sea areas beyond national jurisdiction and their resources, to avoid or mitigate their interference and damage to marine biodiversity. However, there is a division of opinion among the international community over whether to include high-seas fisheries in the BBNJ agreement.

The United Nations Convention on the Law of the Sea has established the basic institutional framework for ocean governance. However, it is not perfect, nor omnipotent. As the third implementation agreement of the United Nations Convention on the Law of the Sea in the future, one of the purposes of the BBNJ Agreement is to improve the legal system of the United Nations Convention on the Law of the Sea on maritime areas beyond national jurisdiction. At present, there are still some defects in the system of high-seas fisheries, including the United Nations Convention on the Law of the Sea. For example, it does not reflect the principles of the ecosystem and comprehensive management, and cannot meet the needs of conservation and sustainable development of high-seas fisheries. Fishery resources are an important part of biodiversity in sea areas beyond national jurisdiction.

The BBNJ Agreement should no longer follow the previous method of sectoral management of the oceans but should cover all resources that constitute biodiversity in sea areas beyond national jurisdiction, and regulate and manage them as a whole.

The current academic studies on the high-seas fisheries issue mainly focus on three aspects. First, the marine protected areas (MPAs) on the high seas—There have been academic works discussing the establishment of MPAs on the sea areas beyond national jurisdiction [2], and whether the MPAs should be included in the BBNJ Agreement [3]. However, the scope of the MPAs on the high-seas is too broad and covers many marine biodiversity issues, and high-seas fisheries are one of them. The management of the high-seas fisheries issue needs to be more specific and focused. Second, illegal, unreported, and unregulated fishing (IUU fishing) on the high seas—Some academic research focuses on the IUU fishing on the high-seas, and whether the latest draft text of BBNJ negotiation can solve such a problem [4]. However, such studies only focus on IUU fishing and do not discuss other issues of high-seas fishing, such as overfishing and accidental catching of deep-sea vulnerable fish stocks. Third, high-seas fisheries agreements in the arctic—Countries in the arctic region have negotiated and concluded agreements on regional high-seas fisheries, which have been critically studied by academic scholars [5]. However, the high-seas fisheries agreement in the arctic is a regional treaty, which does not have the global influence of the BBNJ negotiation. The pertinent literature indicates a gap in the systematic study and the holistic evaluation of the relationship between the high-seas fisheries issue and the BBNJ agreement.

By analyzing the relationship between the high-seas fisheries issue and the BBNJ Agreement, this paper maintains that the issue of high-seas fisheries should be included in the BBNJ Agreement. From the perspective of the conservation of marine biodiversity, the unity of marine ecosystems, and the consistency of regulations, the issue of high-seas fisheries should be included in the BBNJ Agreement. This paper proposes some specific countermeasures and suggestions for some legal obstacles it may be confronted with. By adopting such systematic and holistic analysis of the relationship between the high-seas fisheries issue and the BBNJ Agreement, this paper wishes to contribute to the conservation of biodiversity and the sustainable use of marine resources in areas beyond national jurisdiction by suggesting the incorporation of the high-seas fisheries issue in the BBNJ Agreement.

2. The BBNJ Agreement and High-Seas Fisheries

At present, the legislative process of the BBNJ Agreement neither addresses its scope of application nor clarifies whether the issue of fisheries on the high seas should be included. Instead, it mainly focuses on setting rules for access to marine genetic resources, benefit-sharing, capacity-building, and technology transfer. Thus, the BBNJ Agreement would not effectively apply to the sea areas beyond national jurisdiction and all its resources in the future, but also exclude the issues of fisheries on the high seas.

(1) The BBNJ Agreement process

Earlier than 2004, the United Nations General Assembly established an open-ended informal ad hoc working group to study biodiversity conservation and sustainable use of marine resources in areas beyond national jurisdiction (hereinafter referred to as the "BBNJ Working Group") [6]. It promoted the attention and study of this issue by many countries and provided ample rationalized suggestions and support for countries to co-operate in resolving this issue. The Preparatory Committee (hereinafter referred to as the "Preparatory Committee") finalized the draft BBNJ Agreement. In December 2017 [7], the General Assembly resolved to convene an intergovernmental meeting to formally negotiate the BBNJ Agreement. It also decided to hold four intergovernmental meetings between September 2018 and 2020 to agree on the text of the BBNJ Agreement, to improve the relevant provisions of the United Nations Convention on the Law of the Sea.

The draft agreement proposed by the Preparatory Committee is divided into parts A and B [8], and the two parts are interrelated. There are eight main topics in Part B, three

of which are related to high-seas fisheries. The first relevant issue is the legal principles applicable to genetic resources in marine areas beyond national jurisdiction. One hotly debated issue is whether the "principle of freedom of the high seas" or the "principle of the common heritage of mankind" be applied. It was also one of the main topics of the intergovernmental negotiations, under the responsibility of the Working Group on Marine Genetic Resources [9]. The second related topic was the disagreement over the management and decision-making modalities of the zoning management tools, including how future legal mechanisms do not undermine existing legal instruments and frameworks and regional and/or sectoral competencies. This overlaps with the issue of cooperation mechanisms in part A. The third relevant topic was the relationship between the new mechanism established by the future BBNJ Agreement and the existing regional and sectoral legal mechanisms, including how to implement and comply, monitor, and review the relevant rules.

The negotiations of the BBNJ Agreement have reached some consensus in the following areas, and a breakthrough will likely be made in the future in these areas. First, it strengthens the links with existing regional and sectoral mechanisms through the provisions of the BBNJ Agreement; second, it clarifies the general legal principles that apply to the areas beyond national jurisdiction; and third, it coordinates the relationship between the BBNJ Agreement and the existing legal mechanisms. However, it is unclear whether the BBNJ Agreement is a comprehensive agreement applicable to fisheries in areas beyond national jurisdiction, or a specialized agreement dealing only with genetic resources.

(2) Relevant legal systems and existing problems of high-seas fisheries

Internationally, the existing legal mechanisms for international fisheries are inadequate. Taking the United Nations Convention on the Law of the Sea as an example, it only imposes general obligations for due regard (article 87 (2)), the obligation to comply with the provisions of the Convention and other treaties for the freedom of fishing (article 116), the obligations to cooperate for the conservation and management of biological resources (article 118), and some basic conservation measures (article 119). It also establishes a framework of general responsibility for the protection and preservation of the marine environment, as well as the adoption of the necessary measures to protect and preserve rare or fragile ecosystems, and threatened, or endangered species and other forms of marine life (article 194 (5)). However, it lacks relevant legal regulations for non-commercial fishery resources such as discrete fish stocks on the high seas. The United Nations Fish Stocks Agreement also manages fisheries on the high seas poorly [10]. While it has established the legal framework for international fisheries governance, dominated by RFOs, it does not mandate RFOs to act according to its provisions. Additionally, its scope of application is limited. The agreement also applies primarily to fishery resources of commercial value and does not apply to non-commercial fish stocks such as discrete fish stocks [11]. Moreover, the agreement has a very limited effect on the management and conservation of target fish stocks [12]. Although there are currently some global guidelines governing the management of fisheries on the high seas, such as the Code on Responsible Fisheries, these guidelines are only recommendations and lack legally binding force [13].

There are also problems with the case of regional fisheries organizations or arrangements. Firstly, regional fisheries organizations have a limited scope of application, with a limited geographical scope and fish stocks. There are currently more than 20 regional fisheries organizations around the world, but they do not cover all sea areas beyond the jurisdiction of all countries, nor do they cover all fish stocks. Most RFOs are concentrated in the Arctic, Mid-Atlantic, and Southwest-Atlantic waters [14]. For example, the regional fisheries organizations (RFOs), which cover the most extensive areas of benthic fish resources in the high seas, have as many as eight regional organizations, but they do not cover all the sea areas beyond national jurisdiction, covering 77% of the area.

Taking the issue of incidental catch as an example, the sea area under its jurisdiction currently accounts for only 37% of the sea area where the problem of incidental catch exists [15]. Secondly, the regional fisheries management mechanisms are not perfect. There

are major shortcomings in their management methods, most RFOs or arrangements lack effective decision-making mechanisms [16], and many regional fisheries treaties (RFTs) do not include modern environmental protection regimes [17]. The legal effect of RFOs or arrangements is also limited. This is partly due to the lack of financial resources, technology, and capacity of developing countries, partly due to the closure of some RFMOs themselves, and partly due to the limited capacity of regional organizations or arrangements themselves, whose management and conservation measures cannot be applied to non-parties or non-target fish stocks [18]. Thirdly, the issues have arisen due to the absence of coordination mechanisms among RFOs and the lack of cooperation among them. Therefore, there are still many problems that need to be solved in the development of the legal mechanisms for high-seas fisheries.

(3) Relationship between BBNJ Agreement and High-seas fisheries

The issue of fisheries on the high seas is inextricably linked to the BBNJ Agreement. High-seas fisheries are not only the main threat to the biodiversity of areas beyond national jurisdiction [19], but are also one of the main problems that need to be addressed in the comprehensive management of sea areas beyond national jurisdiction.

The close connection between the two is also reflected in the relevant materials for the preparation of the BBNJ Agreement [20]. Reference is made in the recommendations of the Preparatory Committee on the identification and establishment of zoning management tools, including marine protected areas, which require an assessment and provision of a range of information on the marine environment and living resources, such as vulnerability and threats, ecological environment, global or regional or sectoral institutional arrangements, measures taken, and socio-economic conditions. It also suggested that consultation and cooperation with relevant global, regional, and sectoral institutions on relevant matters be stipulated. The president's statement noted that states or competent organizations could make proposals for the establishment of marine protected areas, including regional organizations. It also pointed out that proposals for the application of zoning management tools should be made public to all organizations, including regional and sectoral bodies. Reference was also made to regional and sectoral bodies in the president's instrument facilitating the negotiations. The reference to regional and sectoral bodies in the above-mentioned document certainly includes and mainly refers to regional fisheries organizations or arrangements.

The Preparatory Committee recommended that the provisions for environmental impact assessment should include not only possible environmental impacts but also cumulative environmental impacts. This requires the collection of information on a variety of areas, including fishery resources. The Preparatory Committee also recommended that the provisions for environmental impact assessment should be linked to existing environmental impact assessment standards for relevant global, regional or sectoral legal instruments, and organizational frameworks. At the first intergovernmental negotiating meeting the working group responsible for environmental impact assessment discussed minimum international standards for consultation with regional organizations or sectoral bodies on environmental impact assessment. It also indicated that activities carried out by existing regional or sectoral environmental impact assessments did not require further assessments. If the activity was permitted, no further assessment is required. It is emphasized that these assessments should be in line with the requirements of the BBNJ Agreement on environmental impact assessment. It is noteworthy that the instrument that the president assisted in the negotiation with explicitly includes the International Guidelines for the Management of High Seas Fisheries developed by the Food and Agriculture Organization of the United Nations as the standard for the BBNJ environmental impact assessment [21].

3. Disputes over Whether the Issue of High-Seas Fisheries Should Be Included in the BBNJ Agreement

The international community has different views on whether the issue of high-seas fisheries should be included in the BBNJ Agreement. From the current trend of negotiations,

the high-seas fisheries issue is likely to be excluded from the BBNJ Agreement. However, high-seas fisheries issues should be included in the BBNJ Agreement given the objective need for the conservation and management of sea areas beyond national jurisdiction.

(1) Disagreements over whether the issue of high-seas fisheries should be included in the BBNJ Agreement

At present, the international community still has serious differences on whether the issue of high-seas fisheries should be included in the BBNJ Agreement. Some countries, such as Iceland, Japan, and Russia, strongly oppose the inclusion of high-seas fisheries in the agreement [22]. They believe that the existing regional fisheries management organizations or arrangements are the most effective mechanisms for managing high-seas fisheries, so the BBNJ Agreement does not need to address high-seas fisheries. The African Group, Costa Rica, Indonesia, Jamaica, New Zealand, Norway, Peru, and the United States issued statements in favor of including fisheries issues in the agreement [23]. Some non-governmental organizations also believe that the BBNJ Agreement should be a comprehensive agreement, which should address the issue of high-seas fisheries [24]. There are also differences within the EU. Some member states support the inclusion of high-seas fisheries in the agreement, while some oppose it [25].

At the same time, the rise of the issue of whether high-seas fisheries should be included in the BBNJ Agreement is also reflected in the debate on whether genetic resources (hereinafter referred to as "MGRs") include fish resources. Some countries believe that the genetic resources in the sea areas beyond national jurisdiction certainly include fish resources, while some countries are opposed to it. The United Nations Convention on the Law of the Sea does not cover the concept of marine genetic resources. The definition of this in the Convention on Biological Diversity is widely used in practice. According to the Convention on Biological Diversity, genetic resources refer to substances containing genetic functional units from any plant, animal, microorganism, or other sources. Logically speaking, it includes fish and its derivatives, but there are also objections in the academic community. Marciniak, a scholar, believes that the BBNJ Agreement should distinguish the nature and use of marine genetic resources, to regulate them separately [26].

(2) Reasons why high-seas fisheries should not be included in the BBNJ Agreement

At present, there are four main arguments against the inclusion of high-seas fisheries issues in the BBNJ Agreement. First, to reach a BBNJ agreement as soon as possible, discussion on issues with greater controversy should be excluded. Since the BBNJ intergovernmental negotiation, the negotiation practice seems to avoid controversial matters, given the large dispute among countries over whether the high-seas fisheries issue should be included in the BBNJ Agreement.

Second, from the perspective of the genetic characteristics of marine genetic resources and their benefit sharing, the issue of high-seas fisheries should not be included in the BBNJ Agreement. At the first intergovernmental negotiation meeting held from 4–17 September 2018, the Chairman's report stated that it should be distinguished whether fish and other biological resources are genetic resources or commodities, and the BBNJ Agreement is only applicable to biological resources with genetic characteristics . Moreover, fishery resources as commodities already have relevant legal systems, thus high-seas fisheries should be excluded from the BBNJ Agreement.

Third, from the text of BBNJ negotiation materials, it has a small scope of application and does not involve high-seas fisheries. In the chairman's report of the first intergovernmental negotiation, the reference to "integration" and related concepts was reduced. For example, "integration" was not mentioned once, the ecosystem was mentioned twice, the connected network was mentioned once, and inclusiveness (between relevant mechanisms) was mentioned once; however, more attention was paid to the term "cooperation", which was mentioned in 32 places and 34 departments. From the above text, the international community is more inclined to formulate an agreement with a smaller scope of application, that is, to exclude the issue of high-seas fisheries, to ensure that the existing legal mecha-

nism is not compromised. It is emphasized to strengthen the cooperation between existing mechanisms to ensure the coordination between the BBNJ Agreement and relevant legal documents and organizations.

Fourth, some delegations and scholars believe that because the United Nations General Assembly has put forward the requirement of "not undermine" for the BBNJ Agreement, the United Nations Convention on the Law of the Sea, the United Nations Fish Stocks Agreement, and regional fisheries agreements have already involved high-seas fisheries issues. Therefore, this issue should not be within the scope of BBNJ's negotiations.

(3) Reasons why high-seas fisheries should be included in the BBNJ Agreement

From the perspective of protecting the marine environment, conserving marine biodiversity, and considering the original intention of formulating the BBNJ Agreement, the high-seas fisheries issue should be included in the BBNJ Agreement for the following reasons.

First, the issue of high-seas fisheries is the main threat to biodiversity in sea areas beyond national jurisdiction. To achieve the goal of conservation and sustainable use of biodiversity in sea areas beyond national jurisdiction, the issue of high-seas fisheries should be included in the BBNJ Agreement. The problem of high-seas fisheries is mainly manifested in overfishing, IUU fishing, and incidental catch of deep-sea vulnerable fish stocks. In addition, the progress of fishing gear and fishing technology, such as the use of large-scale trawling gear, has also caused greater damage to the entire marine ecosystem, especially the ecosystems in the outer sea areas under the jurisdictions of vulnerable countries [27]. Take overfishing as an example, according to the FAO report, 33.1% of the monitored species are overfished and 59.9% are at or near the maximum sustainable yield [28]. Overfishing on the high seas is more serious than in those areas under national jurisdiction. According to the research report by the FAO, the overfishing rate of high seas and straddling fish stocks is almost twice that of the same or similar coastal fish stocks [29].

Second, the current legal mechanism for ocean governance cannot eliminate the cumulative impact of human activities on the ocean, and the management of sea areas beyond the national jurisdiction is relatively decentralized. In detail, the sea areas beyond the national jurisdiction are mainly controlled by the flag state over its nationals, ships, and activities under its control. At the same time, different competent international organizations have specialized in fisheries, shipping, environmental protection, seabed mining, and marine scientific research. The current decentralized legal mechanism for ocean governance, lacking communication and coordination mechanisms, cannot eliminate the cumulative impact of human activities on the oceans, which has constituted a huge threat to the conservation of marine biodiversity [30]. Cooperation is essential for the effective management of specific activities beyond national jurisdiction or the protection of the entire marine environment [31]. Only by incorporating the high-seas fisheries issue into the BBNJ Agreement can we truly promote the cooperation and development of various legal mechanisms and achieve the goal of conservation and sustainable use of biodiversity in the sea areas beyond the national jurisdiction.

Third, the inclusion of high-seas fisheries issues in the BBNJ Agreement will help promote the reform of marine governance. The preamble of the United Nations Convention on the Law of the Sea points out that "the integrity of the marine ecosystem should be maintained". Moreover, the comprehensive management of the ocean is more in line with its ecological characteristics. As early as 2002, the Johannesburg Plan of Implementation formulated by the World Summit on Sustainable Development proposed the integrated management of oceans and seas [32]. This principle runs through chapter 17 of the report by the United Nations Conference on Environment and Development [33]. Article 6 (b) of the Convention on Biological Diversity requires parties to adopt an integrated approach to biodiversity conservation by their respective conditions and capacities. Despite the voice of the international community on integrated ocean management, it is not yet an obligation under international law [34].

Fourth, whether or not the BBNJ Agreement involves high-seas fisheries, its application and implementation will inevitably have a direct or indirect impact on high-seas fisheries.

As far as environmental impact assessment is concerned, if there are reasonable grounds to suspect that the proposed activities will cause significant and harmful changes to the marine environment, it is necessary to assess their possible impacts. This is not only an international law obligation under Article 206 of the United Nations Convention on the Law of the Sea, but also customary international law [35]. Although the current international law does not specify how to conduct an environmental impact assessment, it can be clear that all activities located in the same space or interacting with each other need to be assessed together. Zoning management tools and their application are closely related to the issue of high-seas fisheries. The practice of high-seas marine protected areas, the Convention on the Conservation of Antarctic Marine Living Resources and the Convention for the Protection of the Marine Environment of the Northeast Atlantic Ocean show that high-sea fisheries have a significant impact on the scope of application of marine protected areas, the formulation of specific rules, and the measures taken, especially in the sea areas where human activities are more active.

Last, the opportunity to compile the rules of the law of the sea is precious. We should use the opportunity to formulate the BBNJ Agreement to promote the improvement of the legal system of maritime areas beyond national jurisdiction, including high-seas fisheries. Historically, the international community has compiled the law of the sea four times. They were the Hague Codification Conference in 1930, the First Conference on the Law of the Sea in 1958, the Second Conference on the Law of the Sea in 1960, and the Third Conference on the Law of the Sea in 1973. Only two of the four opportunities achieved the goal of codification and progressive development of the law of the sea. The two meetings were the First Conference on the Law of the Sea and the Third Conference on the Law of the Sea. The former formulated the four Geneva Conventions on the Law of the Sea, and the latter adopted the United Nations Convention on the Law of the Sea [36]. In fact, in the whole process of promoting the BBNJ Agreement, all parties generally believed that it was necessary to solve the problem of high-seas fisheries. For example, in 2006, the Ad Hoc Open-ended Informal Working Group listed destructive fishing and illegal, unreported, and unregulated fishing as the main threats to biodiversity [37]. It reiterated this in 2014. Although statements made in the informal process and negotiations are not the outcome of the agreement, they are important evidence reflecting the positions of all parties. Therefore, it is reasonable to include the issue of high-seas fisheries in its framework.

4. Legal Obstacles to the Inclusion of the BBNJ Agreement in High-Seas Fisheries

The main legal obstacles to the inclusion of high-seas fisheries issues in the BBNJ Agreement are: how to meet the "not undermine" requirements of the United Nations General Assembly for the BBNJ Agreement, how to position the relationship between the BBNJ Agreement and the existing fisheries legal mechanism, how to determine the purpose and scope of application of the BBNJ, and how to deal with the different legal systems of the high seas and the area.

(1) Limitation of the "not undermine" clause

For the requirement of "not undermine", the General Assembly of the United Nations requested that the process of the BBNJ Agreement negotiation should not undermine the existing relevant legal instruments and frameworks, as well as the relevant global, regional, and sectoral organizations. The instrument that the chairman assisted in with the negotiations stated that nothing in this instrument shall prejudice the jurisdiction, rights, and obligations of states under the law. This instrument shall be interpreted and applied within the scope of the United Nations Convention on the Law of the Sea and in a manner consistent with it.

Some countries believe that if the issue of high-seas fisheries is included in the BBNJ Agreement, it will overlap with the existing legal regime for fisheries, which may detract from the existing legal regime and relevant mechanisms. Some countries understand that with the "not undermine" requirement the BBNJ Agreement should not deal with the problems that have been stipulated in existing international legal documents. However,

"not undermine" does not refer to no overlap and no repetition. Therefore, it is important to accurately and reasonably interpret the meaning of "not undermine".

(2) How to define the relationship between the BBNJ agreement and the existing legal mechanism

The President's statement reported that the relationship between the BBNJ Agreement and all relevant legal instruments and frameworks, including the United Nations Convention on the Law of the Sea, should be stipulated, but there was no consensus on whether to adopt general provisions or separate provisions in different parts. To define the relationship between the BBNJ Agreement and the existing legal mechanism, it is necessary to clarify that whether the BBNJ Agreement is a repair to the existing legal mechanism on the premise of an accurate understanding of "not undermine", or change to the existing marine governance mechanism. Clarifying this issue will not only help to determine the purpose of the BBNJ Agreement but also help to clarify the scope of application of the agreement. As one commentator pointed out, this would help to harmonize the relationship between the new agreement and existing legal instruments, particularly fisheries arrangements [38]. In other words, to clarify this issue is to clarify whether the BBNJ Agreement includes high-seas fisheries.

(3) The Scope of Application of the BBNJ Agreement

At present, the BBNJ Agreement negotiation process has not clarified the scope of application of the agreement. The background of the BBNJ Agreement is the awareness of protection, the importance of biodiversity in sea areas beyond national jurisdiction. However, whether the purpose of the BBNJ Agreement is to formulate general legal rules applicable to sea areas beyond national jurisdiction or only to establish general legal rules for genetic resources in sea areas beyond national jurisdiction cannot be determined from the current relevant information. Therefore, it is difficult to judge its scope of application. In other words, it is uncertain whether it includes high-seas fisheries.

Twenty-one principles were put forward in the instrument that the chairman assisted with in the negotiation, including due regard, the precautionary approach, comprehensive international cooperation and coordination at all levels, promoting the conservation and sustainable use of marine life, stakeholder engagement, ecosystem-based management method, scientific management, and information disclosure. From the perspective of these rules, they are universally applicable, not limited to marine genetic resources in areas beyond national jurisdiction, but also applicable to other resources, including high-seas fisheries resources. From its relationship with relevant legal documents, the BBNJ Agreement should maintain compatibility and consistency with the United Nations Convention on the Law of the Sea and its implementation agreements, such as the United Nations Fish Stocks Agreement. For example, the working group responsible for the zoning management tool mentioned that the future BBNJ Agreement should maintain compatibility and consistency with relevant treaties, including the United Nations Fish Stocks Agreement. Therefore, the BBNJ Agreement should apply to high-seas fisheries. However, the opinion of the Working Group on Marine Genetic Resources is that the BBNJ Agreement does not cover fisheries resources as commodities.

(4) How to coordinate the overlapping jurisdiction of maritime zones and high seas

According to the United Nations Convention on the Law of the Sea, the outer continental shelf belongs to the sea area under national jurisdiction and is under the jurisdiction of coastal states; the principle of freedom of the high seas shall apply to the high seas, which shall be under the jurisdiction of the flag state. The area is governed by the principle of the common heritage of mankind and is managed by the International Seabed Authority on behalf of the international community. The high seas and the area overlap geographically, as do some of the high seas and the outer continental shelf under national jurisdiction. Taking the genetic resources in the above-sea areas as an example, it is one of the legal obstacles that the BBNJ Agreement needs to solve to apply to the same legal rules or different legal rules.

5. Specific Proposals for Incorporating High-Seas Fisheries Issues into the BBNJ Agreement

To ensure that the BBNJ Agreement meets the requirements of the United Nations General Assembly and is compatible with existing legal mechanisms and serves the purpose of conservation and sustainable use of biodiversity in sea areas beyond national jurisdiction, high-seas fisheries should be included in the regulation. It is recommended to adopt general legal norms and formulate conflict clauses and to establish mandatory international cooperation and international obligations for integrated ocean management to address the above legal obstacles.

(1) Adopt general legislative norms

The general norms, because of their general expression, help to strengthen the connection and coordination between the BBNJ Agreement and other legal documents; at the same time, it can ensure the flexibility of the BBNJ Agreement, broaden the scope of application of the agreement, and facilitate the coordination between the provisions of the BBNJ Agreement and other legal documents or organizations, to deepen the cooperation of existing legal mechanisms and better deal with the complex and changing marine environment. In addition, they can serve as the core concepts and values of sea area governance beyond national jurisdiction, and guide the marine policies and practices of countries. We can also improve the existing legal mechanism through their interpretation. Many scholars believe that this legislative approach is essential for the conservation and sustainable use of sea areas beyond national jurisdiction [39]. Many existing international agreements adopt this legislative approach, such as Article 5 of the United Nations Fish Stocks Agreement, Article 2 of the Convention for the Protection of the Marine Environment of the Northeast Atlantic Ocean, Article 3 of the Convention for the Protection of the Baltic Sea Marine Environment, and Article 3 of the United Nations Framework Convention on Climate Change.

(2) Conflict and Compatibility Clauses

We should accept overlap and potential conflicts and remain open-minded. The current mechanisms of the law of the sea, or between global and regional mechanisms and regional mechanisms (such as regional fisheries organizations and regional environmental protection organizations), all overlap to some extent. This is unavoidable and normal. Therefore, in the process of formulating the BBNJ Agreement, we should not avoid the problems or disputes that need to be resolved.

To prevent future conflicts or disputes, it is suggested to coordinate the relationship between existing legal instruments, organizational mechanisms, and the BBNJ Agreement by adding conflict norms. Moreover, the BBNJ negotiation process also referred to the resolution of possible problems through "conflict clauses". The intergovernmental meeting endorsed the general principles mentioned in the chairman's assistance in negotiating the instrument and the conflict clauses concerning the principles applicable to specific matters [40].

In international practice, some treaties define their relationship with the past or relevant treaties at a macro level. For example, Article 311 of the United Nations Convention on the Law of the Sea stipulates that it shall take precedence over the 1958 Geneva Conventions on the Law of the Sea, but shall not alter the rights and obligations of the contracting states arising from other agreements consistent with this convention, and shall not affect the enjoyment of their rights or the performance of their obligations by other contracting states under this convention. Article 4 of the United Nations Framework Convention on Climate Change stipulates that any provisions of this agreement shall not prejudice the rights, jurisdiction and obligations of states under this convention. This agreement shall be interpreted and applied within the scope and in a manner consistent with this convention. Article 44 of the United Nations Framework Convention on Climate Change also stipulates that this treaty shall not alter the rights and obligations of state parties arising from other agreements consistent with this agreement, nor shall it affect the enjoyment by other state parties of their rights or obligations under this agreement. Some treaties require compatibility and consistency at the micro level. As required by Article 7 of the United Nations

Convention on Food Security. The conservation and management measures developed for the high seas and those adopted in areas under national jurisdiction should be compatible to ensure the conservation and management of straddling fish stocks and highly migratory fish stocks as a whole.

It is worth noting that ensuring compatibility does not emphasize which is higher or which is lower, or that it has priority, and only considers the same subject of protection and management or the consistency of measures taken. This not only emphasizes the importance of maintaining the "unity of biological systems", but also emphasizes that these measures "will not have harmful effects on the entire biological resources", and will not damage the existing legal mechanisms. Each of the above methods has its advantages and disadvantages. The macro-conflict clauses are exploitative, and the negotiation time is short, so it is easy to reach a consensus. Micro conflict norms may be more targeted in coordinating specific rights and obligations that may overlap (or conflict), but negotiations take a long time and it is not easy to reach a consensus. Regardless of the nature of such provisions, their purpose is to identify the priority application of relevant provisions relating to the same matter.

As far as the relationship between fisheries issues and the BBNJ Agreement is concerned, the key issue is to formulate conflict norms to resolve the relationship between the BBNJ Agreement and regional fisheries management mechanisms in areas beyond national jurisdiction [41]. This will promote the development and improvement of international fishery law in areas beyond national jurisdiction.

(3) Establishing mandatory international cooperation obligations

In addition to the inclusion of conflict clauses in the BBNJ Agreement, cooperation between subjects of international law in the sea areas beyond national jurisdiction should also be strengthened. The current provisions on international cooperation are suggestive. As the sea areas beyond the national jurisdiction belong to the common property of all mankind, they are of great significance to the entire Earth's ecosystem and face serious threats. If we hope to reverse the deteriorating trend of biodiversity and ecological environment in the sea areas beyond national jurisdiction as soon as possible, the BBNJ Agreement should provide for mandatory international cooperation obligations to avoid the "tragedy of the commons" because no international organization or country can change the status quo by itself.

The report of the preparatory committee has repeatedly emphasized strengthening international cooperation. The chairman assisted in negotiating the instrument reaffirming the importance of international cooperation. However, there is no clear way and content of cooperation, only pointing out strengthening cooperation and coordination with existing relevant legal instruments and frameworks, including global, regional, and sectoral institutions. In the BBNJ Agreement, strengthening cooperation mainly means that countries or international institutions, whether regional organizations (such as regional fisheries organizations) or international organizations (such as the International Seabed Authority), deepen cooperation through various ways [23]. Taking fisheries as an example, cooperation should be wider than what the provisions of the United Nations Convention on the Law of the Sea requested, such as Articles 61 (2), 63 (2), 64 (1), 65, 66, 69 (3), 70 (4), and 118.

The chairman promoted that the negotiation instrument had listed the corresponding cooperation obligations that countries should undertake [42]. However, the content should still be expanded to strengthen cooperation within and among international, regional, and sectoral institutions. This involves the complex issue of the status of the parties with regards to the BBNJ Agreement. For example, sometimes countries are both independent subjects of international law and members of intergovernmental international organizations. It needs to be clarified in what capacity they should join the organizational mechanism of the agreement and what obligations they should undertake.

In addition, it is suggested that the BBNJ agreement should allow regional and sectoral institutions to join the agreement to fulfil their rights and obligations under the agreement. Moreover, the BBNJ Agreement should also make it clear that it is a mandatory obligation

for countries to undertake promoting international cooperation. For example, the BBNJ Agreement can provide that countries should cooperate directly or through regional, sectoral, or international institutions to "achieve the objectives of the BBNJ Agreement". This obligation applies to international cooperation at any level. For example, it may be stipulated that "States are urged to take measures to promote cooperation among international organizations to which they are members". Some regions have already started such practices. For example, in 2008, the Commission for the Protection of the Marine Environment of the North East Atlantic signed a memorandum of understanding on cooperation with the North East Atlantic Fisheries Commission [43].

The BBNJ Agreement can also provide that state parties are required to encourage national and international arrangements of non-parties to cooperate in the conservation and sustainable use of sea areas beyond national jurisdiction. These practices are based on the will of countries or organizations and do not constitute damage to existing legal mechanisms. In addition, we can also learn from the WTO General Council's provisions on mutual compliance when making decisions. There are also provisions on regional cooperation and sectoral coordination in the United Nations Convention on the Law of the Sea, such as the provision that "States consider cooperation through competent authorities". The above approaches can not only promote the coordination between the BBNJ Agreement and existing legal instruments and mechanisms, but also respect and not detract from the competence of various existing subjects of international law.

(4) Establishing international obligations for the integrated management of oceans

As mentioned earlier, there is a high demand for integrated ocean management, but it is not a rule of international law. To achieve the conservation and sustainable use of biodiversity in sea areas beyond national jurisdiction, the current sector-based management mode must be changed. This kind of management mode has the defects of being independent and fragmented, which does not conform to the fundamental characteristics of ocean integrity and ecosystem connectivity. It cannot eliminate the cumulative impact of human activities on the oceans. To achieve the purpose of the BBNJ Agreement, it is necessary to establish the international legal obligations of integrated ocean management. Based on this, it is necessary to incorporate the high-seas fisheries issue into the BBNJ Agreement, and to take measures to comprehensively manage the sea areas beyond the national jurisdiction to eliminate the direct and cumulative impacts of human activities on them. Moreover, the comprehensive management of the sea areas beyond national jurisdiction is also conducive to eliminating the overlap and conflict of the legal systems of the outer continental shelf, the high seas, and the area.

6. Conclusions

The high-seas fisheries issue is seen as the major threat to biodiversity in areas beyond national jurisdiction. The discussion of the BBNJ Agreement is gaining momentum, this paper takes this opportunity and proposes the inclusion of the high-seas fisheries issue into the BBNJ Agreement to address the integrated and sustainable management of the fisheries issue in areas beyond the national jurisdiction. This paper first evaluates the agenda and process of the BBNJ Agreement and the problems that exist in the current legal system with regards to high-seas fisheries, and then analyzes the relationship between the high-seas fisheries issue and the BBNJ Agreement.

This paper maintains that the high-seas fisheries issue is inextricably linked to the BBNJ Agreement. This paper summarizes the current dispute over the inclusion of the high-seas fisheries issue in the BBNJ Agreement and evaluates the supporting and dissenting opinions in this debate. It is believed that the high-seas fisheries issue should be incorporated into the current discussion of the BBNJ Agreement from the perspective of protecting the marine environment and conservation of marine biodiversity in areas beyond national jurisdiction. This paper identifies the legal obstacles to including the high-seas fisheries issue in the BBNJ Agreement. These legal obstacles include the limitations of the interpretation of the "not undermine" clause, the need to define the relationship between the BBNJ Agreement and

the existing legal norms on high-seas fisheries, the need to define the scope of application of the BBNJ Agreement, and the problem of coordination of the overlapping jurisdiction of maritime zones and high seas.

In light of the legal obstacles aforementioned, this paper proposes some specific measures to ensure the incorporation of the high-seas fisheries issue into the BBNJ Agreement. This paper suggests the adoption of certain general legislative norms that ensure the flexibility of the BBNJ Agreement and broaden its scope of application. A conflict and compatibility clause is suggested to accommodate the overlap and potential conflicts with the current norms. Mandatory international cooperation obligation needs to be established, to facilitate the cooperation between international subjects in sea areas beyond national jurisdiction. The legal obligation for integrated management of the ocean ought to be formed, to create binding norms for states to dedicate to the conservation and sustainable use of marine resources concerning the high-seas fisheries issue. Through these proposed measures, the BBNJ Agreement would be compatible with the existing legal norms of high-seas fisheries and would serve to conserve biodiversity in areas beyond national jurisdiction.

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Essay

A Fairer Governance of High Sea Fishing through a Systemic Interpretation Approach

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Abstract: The regulation of high sea fishing would not be successful without cooperation among the states in the current international society, without a world government. However, the ongoing quest for cooperation in the field of fishery governance focuses too much on the unilateral responsibility of a state to cooperate with a RFMO, overlooking the responsibility of state parties of an RFMO or the state seeking to regulate IUU fishing. This essay reveals that the equitable consideration of fishery governance is sometimes prejudiced in the name of conservation. Fishery governance involves food security, employment, free trade, and the environment. An ideal regime of high sea fishing is expected to balance the conflicting values and bring an end to the fragmentation of international law. The systemic interpretation approach, which is based on Article 31, paragraph 3(c) of the Vienna Convention on the Law of Treaties, contributes to a fairer governance of high sea fishing. Such an approach revives the obligation of the state to cooperate in the fishery sector by referring to external legal sources, including human rights laws, WTO laws, and environmental laws.

Keywords: high sea; fishery governance; international law; treaty interpretation; RFMO; IUU fishing

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1. Introduction

In recent decades, the international society has strengthened the regulation over high sea fishing for fear of declines in fish stocks in places beyond national jurisdiction. Much progress has been made in this regard, especially through the practice of regional fisheries management organizations (RFMOs) and the cooperative framework provided by the Food and Agriculture Organization (FAO). Law, both international and domestic, has never been absent in this process. The widespread concern regarding over-fishing has promoted the innovation of international law theory and practice in the direction of making RFMOs measures effective and pushing the cooperation with RFMOs by non-parties thereof. Such a habit is further supported by some international and domestic practices. The former includes the making of some landmark treaties, for example, the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (the Fish Stocks Agreement), which stipulates that only the states that are members of the relevant RFMO, or who agree to apply the measures established by the RFMO, shall have access to the fishery resources in question [1] (Article 8). The latter includes the legislation by some port or market states to deter the illegal, unreported, and unregulated (IUU) fishing identified by an RFMO [2], and the legislation or measures by some flag states to voluntarily forbid IUU fishing, even in areas within the competence of an RFMO to which the flag state is not a member. The morally sound language of conserving living marine resources is shaking the foundations of the customary nature of the freedom of the high seas.

To fight against over-fishing on the high seas seems to have become a mainstream discourse in marine governance. This goal cannot be achieved without cooperation among the states in the current international society, without a world government. Indeed, international cooperation has become a cornerstone in international law since the Second World

War. State obligations regarding international cooperation permeate different branches of international law, from human rights to ocean affairs. In the field of fishery governance, for instance, the Fish Stocks Agreement provides that coastal states and states fishing on the high seas have a general duty to cooperate [1] (Article 5). The literal meaning of cooperation entails endeavors from two sides of participators. However, the ongoing quest for cooperation in the field of fisheries governance focuses too much on the unilateral responsibility of a state to cooperate with an RFMO, overlooking the responsibility of state parties of an RFMO or the state seeking to regulate IUU fishing. It reflects a preconceived idea of giving priority to the protection of living marine resources, rather than other legitimate interests. This is understandable at a preliminary stage of seeking regulation, but its fairness deficiencies are also obvious, accompanied by the doubt concerning whether the current RFMOs practice is genuinely running towards their purported goal of conserving living marine resources [3]. It is time to seriously rethink the meaning of state obligation to cooperate in the fishery sector.

Just as the freedom to fish on the high seas is not absolute, the maintaining of fish stocks is also not necessarily a supreme value. Other values, such as human rights, free trade, and the equitable allocation of resources, are equally important in fishery governance. An ideal regime of high sea fishing is expected to balance the conflicting values and to bring the fragmentation of international law to an end. It is generally believed that the systemic interpretation method can harmonize the fragmented branches of international law [4]. The systemic interpretation requires an interpreter to consider other rules of international law in the process of treaty interpretation. Given the central role of states in the international arena and the emphasis of cooperation among states regarding thorny issues in recent international law practice, this essay undertakes to explore how a systemic interpretation approach in regard to state obligations for international cooperation contributes to a fairer governance of high sea fishing. It particularly probes how the conservation and non-conservation concerns shape the meaning of state obligation to cooperate under Article 5 of the Fish Stocks Agreement. It aims to find a way to integrating different aspects of state cooperation in the discourse of high sea fishing regulation.

2. The Unbalanced Problem of the Current Legal Regimes Regarding High Sea Fishing

2.1. International Efforts to Enhance the Authority of RFMOs

Different from the international seabed, the high seas are not defined as the common heritage of mankind. Instead, the fishing resources of the high seas are subject to free exploitation, notwithstanding some limitations on the freedom of the high seas, according to the United Nations Convention on the Law of the Sea (UNCLOS), a basic legal instrument concerning marine affairs. The conservation of fish stocks, which heavily depends on state willingness to cooperate, is prima facie fragile due to the historically dominant notion of the freedom of the high seas. In the face of the difficulty in conserving fish stocks, the international law community has endeavored to enhance the authority of, and to promote state cooperation with, relevant RFMOs which usually works by way of setting catch limits and allocations on fishing efforts for a state member and making decisions to forbid or limit certain fishing methods.

The Fish Stocks Agreement, embracing 92 state parties, accounting for approximately half of the international community, has in fact limited the freedom of high sea fishing, to a large extent. For example, non-members of an RFMO are required to abide by their duty to cooperate by becoming members of such an organization, participants in such an arrangement, or by agreeing to apply the conservation and management measures established by such an organization or arrangement [1] (Article 8.3). A non-member state shall not authorize vessels flying its flag to engage in fishing operations for fish stocks which are subject to the conservation and management measures established by such an organization [1] (Article 17.2). The binding effects of the RFMO measures on non-members are still based on state consent, which can be found in the Fish Stocks Agreement. Perhaps

it is too early to assert that the Fish Stocks Agreement has acquired customary status. However, given the fact that most fishing states have joined this agreement and that some non-parties have, in fact, followed the basic principles therein, there is a strong indication that the Fish Stocks Agreement may become customary law in the future, or at least serve as opinio juris, which is one of the two conditions for forming customary international law [5]. For example, China, the world's top producer of marine captures [6], has banned its national vessels from catching southern bluefin tuna in the area within the competence of the Commission for the Conservation of Southern Bluefin Tuna (CCSBT)—of which China has not become a member [7]— although China is not a state party to the Fish Stocks Agreement.

In addition to the Fish Stocks Agreement, other treaties also call for state cooperation with RFMOs. For example, although state parties to the Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (the port State agreement) do not become bound by measures or decisions of an RFMO of which they are not a member, they shall to the greatest extent possible, take measures in support of conservation and management measures adopted by other states and other relevant international organizations, including RFMOs [8]. The newly adopted WTO agreement on fishery subsidies provides that no member shall grant or maintain any subsidy to a vessel or operator engaged in IUU fishing identified by a RFMO, irrespective of whether the state is the member of the RFMO [9]. In so far as conserving fish stocks relates to biodiversity, the currently negotiated treaty on Biodiversity beyond National Jurisdiction (BBNJ) deserves mention. A key goal of the BBNJ negotiation is to strengthen area-based management tools, including marine protected areas (MPAs). A few, if not all, RFMOs may be deemed as MPAs in a broad sense [10]. The latest version of the drafted BBNJ treaty provides that states shall cooperate for the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction, including through strengthening and enhancing cooperation with and promoting cooperation among relevant legal instruments and frameworks and relevant global, regional, subregional, and sectoral bodies [11]. This rule, if it were to become a treaty rule, will have served as an evidence of a customary rule, according to the International Law Commission, which states that a treaty rule may reflect a customary rule if it has led to the crystallization of a rule of customary international law that had started to emerge prior to the conclusion of the treaty [5], given that the customary rule of state obligations to cooperate with RFMOs has started to emerge since the Fish Stocks Agreement.

Besides the international law-making process, international judicial organs have also helped to clarify state obligations to cooperate regarding fisheries affairs. For example, the International Tribunal for the Law of the Sea has issued an advisory opinion on state obligations to regulate the IUU fishing conducted by the vessels flying its flag in the exclusive economic zone of another state, including through cooperation with the coastal state [12]. Although the focus of the advisory opinion is the IUU fishing in exclusive economic zones, the rationale articulated by the tribunal may have the potential to justify state obligations to cooperate with RFMOs. From the above narrative, it appears that the current international law practice tends to reinforce the authority of RFMOs, with an eye on the effective regulation of high sea fishing.

2.2. Fairness Concern in the Fisheries Governance

An observation of current RFMO practices may raise some concerns about fairness and justice. Although fairness issues are usually complicated and full of controversy, in the field of fishery governance, fairness can at least be assessed against whether there is a bias among states in terms of the allocation of fishing opportunities on the one hand, and whether there is a bias between state parties of an RFMO as a whole and all other states, in terms of conserving biodiversity, on the other hand.

The fairness concern in regard to allocating justice is either possible among member states, or possible between member states and a non-member of an RFMO. Comparatively,

the former is not as prominent as the latter, because allocating results are per se a compromise among member states, and sometimes internal allocating disputes can be solved through objection procedures and/or compulsory legal proceedings thereafter [13–16]. Usually, these dispute settlement procedures are expected to assess whether the objected decision is inconsistent with the basic document of the RFMO or relative international law, and whether it constitutes discrimination against a member state. So far, real practices of this kind are rare, with perhaps two proceedings conducted before the South Pacific Regional Fisheries Management Organization (SPRFMO) as the only cases in which state objections were reviewed, one initiated by Russia and the other by Ecuador [17]. In these two proceedings, Ecuador did not successfully challenge the decision in question, but Russia won a partial victory by convincing the the penal that the objected decision discriminated against Russia [18,19].

The allocation problems between members and non-members are more pressing, because member states may collectively deprive non-members of fishing opportunities. RFMOs are usually constituted by traditional fishery states, and they allocate catch quotas among themselves. Many industrial fishery states are rich nations and according to a recent study, they have dominated industrial fishing efforts on the high seas [20]. This may provide further incentives for them to preclude non-members from participating in the allocation of fishing opportunities. The constitutional documents of some RFMOs provide that the accession of a new member shall be agreed upon by consensus [13,15]. This may become an obstacle for a new state to participate in the allocation of fishing opportunities. The North-East Atlantic Fisheries Commission (the NEAFC) has even openly stated that non contracting parties should be aware that presently and for the foreseeable future, stocks regulated by the NEAFC are fully allocated, and that fishing opportunities for new members are likely to be limited to new fisheries (stocks not currently allocated) [21]. This problem is rooted in the arrangement of the Fish Stocks Agreement, which calls for state cooperation with an RFMO, but which lacks an adequate guarantee of state rights to participate in the RFMO. For example, Article 17 of the Fish Stocks Agreement provides for the participation by a fishing entity (an administrative region which is not recognized as a state, such as Taiwan), including enjoying benefits from participation, but this article does not mention the participatory rights of an ordinary state. Article 11 provides another example of contempt for fishing opportunities of new states, because they might be tailored by considerations of fishing practices of the new members, their contributions to conservation and management of the stocks, the needs of the coastal states or coastal fishing communities, etc. In this sense, the Fish Stocks Agreement has implied a de jure privilege of old members of an RFMO.

Some might believe that the prejudice against non-members could be justified by the mandate of the RFMOs, which claim to pursue conservation and the sustainable use of fish stocks. Such a decently articulated purpose, if performed in good faith, can, to some extent, make up for the fairness deficiency of RFMOs; however, previous research has revealed that most RFMOs are comprised mainly of states with interests in enhancing or maintaining their domestic fishing opportunities, and that conservation interests are poorly represented in RFMOs [3]. Gjerde et al. have criticized that there are insufficient consequences for poor RFMO performance, and there are no penalties for depleting fish stocks, other than lost fishing opportunities [22]. These structural characteristics can, in turn, explain why most RFMOs are reluctant to genuinely embrace ecosystem-based and precautionary approaches. In this sense, it is arguable that a small number of states are monopolizing fishing opportunities under the guise of conserving living resources, which seemingly prevails over other aspects of fairness.

Some previous studies on fishery governance tended to start from the presumption that to contain the decline of fish stocks is superior to other goals [23]. This may lead to some suggestions of a more effective regulation of high sea fishing, represented by ecosystem-centered doctrine, irrespective of the interests of the states with poor fishing ability, but who wish to fish in the future, as well as the interests of the vulnerable population to make a living in fishery sector or to get access to affordable seafood. In a world susceptible to

the tragedy of the commons, it is desirable to embrace the ecosystem-centered approach to fishery governance. However, such an approach alone might turn into wishful thinking and would not be successful, provided that institutional biases are not removed. At this point, Japan's withdrawal from the International Convention for the Regulation of Whaling (ICRW) in 2019 may serve as an example. Japan's withdrawal was stimulated by its failure in the whaling case before the International Court of Justice (ICJ), in which the court was accused of improperly interpreted the ICRW by giving priority to whale conservation and consequently, ignoring sustainable whaling. Although the ICJ's ecosystem approach is inspiring and was welcomed by some lawyers [24], a recent study has illustrated that its method of interpretation is inappropriate, and its interpretation of the exception clause under the ICRW has intruded on the discretionary power of the states [25]. This example indicates that undue burden on the states may frustrate cooperation regarding fishery governance.

Interestingly, a recent aquatic study shows that, where fisheries are intensively managed, fish stocks are above target levels or rebuilding [26] and according to the annual report of the FAO, global marine captures in 2020 were 78.8 million tons, a decline of 6.8 percent from the peak of 84.5 million tons in 2018 [6] (p.12). These surveys may have some policy implications. A possible interpretation is that current fishery governance has yielded some minor progress through oppressive regional governance, which in fact imposes an external burden on underprivileged states and their populations. For example, the lack of a legal framework for a legitimate membership process ("new entrants problem") in many RFMOs, which was previously mentioned, has been widely criticized as an obstacle to effective fisheries management [27]. A more optimistic interpretation may indicate that people should not exaggerate the plight of fish stock decline, and that it is time to reconsider all the legitimate interests, including the freedom of high seas, free trade, the right to food, and the right to the environment, in the process of fisheries governance in a synthetic way.

3. Diversity of State Obligations on Cooperation and a Systemic Interpretation Approach

3.1. Diversity of State Obligations on Cooperation in Need of a Systemic Interpretation Approach

International cooperation has become a cornerstone of current international law, which is embedded in our increasingly interdependent world [28]. The UN charter has articulated general obligations of states regarding international cooperation for all kinds of matters, ranging from "economic and social progress and development," to "international economic, social, health, and related problems," and to "human rights and fundamental freedoms" [29]. The idea of international cooperation has also been mentioned or implied by some treaties on human rights and free trade [30,31], and reiterated by the UNCLOS and the Fish Stocks Agreement, as mentioned above. In this sense, fishery governance not only requires states to cooperate to conserve fish stocks, but also entails state obligations to cooperate in other aspects, such as the food security, free trade, and employment dimensions of fishery issues. Instead of giving priority to the value of conserving fish stocks, this article seeks to coordinate different and even conflicting interests in the process of fishery governance, because other aspects of justice are not less important than the conservation of fish stocks. This stance is supported by the UN 2030 agenda, in which world leaders have promised to achieve 17 Sustainable Development Goals through international cooperation [32]. To end poverty, to achieve food security and improved nutrition, to reduce inequality within and among countries, and to conserve marine resources are among these goals, which are integrated and indivisible [32].

The difficulty exists in how to balance different interests, and this is prominent in the field of international law, which consists of different subsections, each having a set of particular rules and regimes. This phenomenon is referred to as fragmentation, which characterizes, but also disturbs, international law [33]. As a response, many international law scholars and judicial bodies consider the principle of systemic integration to be an appropriate way to deal with the fragmentation of international law. According to the International Law Commission, international law should be viewed as a legal system, and

its rules and principles act in relation to, and should be interpreted against, the background of other rules and principles [33]. Such a method of treaty interpretation, which is based on Article 31, paragraph 3(c) of the Vienna Convention on the Law of Treaties (1969), constitutes the core of the principle of systemic integration. Such an approach gives due regard to external legal sources in treaty interpretation and can help to avoid the irreconcilable conflicts of norms [34]. In this sense, the Fish Stocks Agreement and regional fishery instruments do not exist in a legal vacuum, and therefore, the articles therein concerning state obligations on cooperation should be interpreted in harmony with other rules of international law, especially the customary rule on the freedom of the high seas, which may be better understood in conjunction with human rights treaties and WTO agreements. By the same token, other branches of international law shall in their respective dispute settlement procedures give due regard to state obligations concerning cooperation under the UNCLOS and the Fish Stocks Agreement. Only in this way can fishery governance entertain the equitable allocation of fishing resources on the one hand, and pursue ecojustice genuinely on the other hand. The following sections show how the conservation and non-conservation concerns in the process of fishery governance can be integrated by way of the systemic interpretation of relevant rules concerning freedom of the high seas, the right to food, the right to work, free trade, and the right to the environment.

3.2. Conservation and Non-Conservation Concerns Reconciled through Systemic Integration

The Fish Stocks Agreement was designed as an implementation agreement of the UNCLOS, and Article 4 provides that the agreement shall not prejudice the rights under the UNCLOS and that it shall be interpreted in a manner consistent with the UNCLOS. As previously mentioned, however, the freedom of the high seas in regard to fishing under the UNCLOS, and even under customary law, is at the risk of being de facto spoiled in the name of conservation. Although total freedom is unfavorable to conservation, a thorough denial of freedom of the high seas is also unwise. The freedom of the high seas not only has a customary nature, but may also have a human rights implication.

It is true that the UNCLOS, which articulates the freedom of the high seas, is not a human rights treaty, and therefore, the obligations thereof are state obligations vis-à-vis another state. This treaty does not confer entitlements upon individuals. The main human rights instruments, including the Universal Declaration of Human Rights, do not contain any explicit article on the freedom of the high seas or the right to fish. However, a state obligation vis-à-vis another state may have the potential to give rise to an individual right, under certain conditions. For example, in the LaGrand Case, the ICJ confirmed that Article 36(1) of the Vienna Convention on Consular Relations, which provides state obligations vis-à-vis another state, created individual rights [35]. By analogy, it is arguable that the freedom of the high seas, if read in conjunction with the right to food and the right to work, may also produce human rights implications.

The right to food and the right to work find their legal provisions, respectively, in Article 11 and Article 6 of the International Covenant on Economic, Social, and Cultural Rights (ICESCR). The ICESCR contains a general article (Article 2) requiring states to realize human rights "through international assistance and cooperation, especially economic and technical," and in the article on the right to food, it reiterates the importance of international cooperation. It is now widely accepted in the human rights literature that state obligations on human rights do not end at its borders, and that state obligations extend to extraterritorial situations and to the affairs that must be addressed through cooperation [36]. Although these social rights do not necessarily denote a direct or an absolute access to fishery resources for food or employment purpose, it can be well argued that state parties of RFMOs shall not arbitrarily deprive non-member states of the opportunity to realize the rights of their own population to food and work through high sea fishing [37,38]. It can also be argued that RFMOs should give due regards to the interests of artisanal fisheries that catch fish mainly for human consumption, as opposed to industrial fisheries, 25% of whose catch is destined for reduction to fish meal and other animal feed [39]. In this sense, the

state parties of RFMOs are expected to leave some quotas for non-member states or directly for fishers, or at least to make an appropriate arrangement for their possible participation in the allocation of resources at the minimum level that can reasonably cater to their food and employment demands. It is argued that a rebuffed state which should have been given membership has a legitimate right to at least partially ignore the RFMO's measures [40]. This equally indicates that state parties of RFMOs or other states seeking to conserve fish stocks may better use market state measures to deter IUU fishing, as European Union does in its IUU Regulation [41], which logically do not prevent non-members from fishing for domestic demands (because non-members can do that by staying away from the RFMO, according to the international law principle of pacta tertiis nec nocent nec prosunt).

Further questions arise as to whether a market state can take whatever measures it likes, and more difficultly, whether non-members of RFMOs can claim access to the seafood market of a state taking strict measures against IUU fishing. To answer these questions, reference should be made to the notion of free trade, another important value of international law. It should be noted that the WTO regime gives ample discretion to a state to adopt trade restrictions for the purpose of conserving exhaustible natural resources [42]. It seems that the right to food and the right to work, possibly claimed by non-members of RFMOs, do not necessitate the exportation of a fish catch to a foreign state, but they may instead argue that an appropriate amount of exportation is necessary for a robust industry on which their domestic fishers rely to make a living, and which ultimately contributes to affordable seafood by more global competition. Interestingly, rich countries tend to blame market interventions, such as subsidies or export restrictions, for higher food prices [43], but they seldom introspect the negative impacts of their market state measures in combating IUU fishing (import restrictions) on the global food market. Given the important role of trade in realizing global food security, it is submitted that market states bear the responsibility to review the reasonableness of relevant RFMO measures prior to the decision on import restrictions, especially whether the RFMO measures genuinely contribute to conservation and whether the practice of the RFMO unduly discriminates against non-members. In this regard, the European Court of Justice is in a good position to push the EU and its member states to assess the reasonableness of RFMO practices before adopting import restrictions in potential judicial cases challenging the legitimacy of the EU IUU regulation.

The recent WTO Agreement on Fisheries Subsidies provides a good opportunity to reconcile free trade and the conservation of fish stocks. Article 3.1 of this agreement generally forbids subsidies to IUU fishing [9]. Article 3.2 defines IUU fishing according to which a vessel or operator shall be considered to be engaged in IUU fishing if an affirmative determination thereof is made by "a relevant Regional Fisheries Management Organization or Arrangement (RFMO/A), in accordance with the rules and procedures of the RFMO/A and relevant international law, including through the provision of timely notification and relevant information, in areas and for species under its competence" [9]. The phrase "in accordance with the rules and procedures of the RFMO/A and relevant international law" gives WTO Dispute Settlement Body (DSB) the competence to review the procedural and substantial aspects of RFMO's decision on IUU fishing in anti-subsidy cases. Although the intensity of review remains to be observed in future cases, the broad term of "relevant international law" under Article 3.2 arguably confers plenty of discretionary power, which may include the possibility to assess the systematic problems of an RFMO, upon DSB. In this sense, WTO DSB may serve as an outside supervisor of RFMOs, and it should take this opportunity to promote a fairer fishery governance.

The systemic interpretation approach can not only raise attention regarding non-conservation concerns, but may also entertain conservation interests. The emerging concept of the right to the environment provides external sources for the interpretation of state obligations to cooperate to conserve living resources under the Fish Stocks Agreement. The right to the environment was not internationally recognized as a formal human right until 2022, when UN General Assembly adopted a resolution on the human right

to a clean, healthy, and sustainable environment [44]. Before this historical resolution, environment-related rights were mainly limited to procedural aspects [45], and only a very few states admitted substantial aspects of environmental rights into their constitution [46,47]. The recent UN resolution for the first time declared, internationally, the human right to the environment, not only in procedural aspects, but also in substantive aspects.

In the UN General Assembly resolution, states recognize that the unsustainable management and use of natural resources and the resulting loss of biodiversity and the decline in services provided by ecosystems interfere with the enjoyment of a clean, healthy, and sustainable environment [44]. The resolution recognizes the right to a clean, healthy and sustainable environment as a human right; and calls upon states, international organizations, business enterprises, and other relevant stakeholders to adopt policies, to enhance international cooperation, to strengthen capacity-building, and to continue to share good practices in order to scale up efforts to ensure a clean, healthy, and sustainable environment for all [44]. This not only requires non-members of RFMOs to cooperate with organization, but also requires state parties of RFMOs to collectively pursue a genuine policy of conservation through decision-making procedures in good faith. If state members of RFMOs fail to fulfill their joint obligations to conserve fishing stocks, any state party of the Fish Stocks Agreement may initiate inter-state proceedings (according to Article 30) to invoke state responsibility under Article 35 thereof against those RFMO members who are also state parties of the Fish Stocks Agreement. Unfortunately, the invocation of such a state responsibility is scarcely known. It is submitted that Article 30 (procedural basis) and Article 35 (substantial basis) of the Fish Stocks Agreement should be actively used, in light of the human right to the environment, to push RFMOs to achieve their goals.

4. Conclusions

The systemic interpretation approach is a useful tool to integrate different and even conflicting interests, including food security, employment, free trade, and the environment, in the process of high sea fishing governance. It can entertain both conservation and non-conservation concerns by taking a holistic view of international law. Such an approach calls for, and will trigger, multiple fishery governance in diverse sectors and at different levels, involving the participation of RFMOs, the European Court of Justice, and other regional or domestic courts of seafood market states, WTO DSB, the dispute settlement regime under the Fish Stocks Agreement, and human rights treaty bodies. Policy suggestions and legal strategies for a fairer fishery governance include: RFMOs should make an appropriate arrangement for non-members to participate in the allocation of fishery resources at the minimum level that can reasonably cater to their food and employment demands; national courts, the European Court of Justice, the WTO DSB, and human rights treaty bodies may serve as external supervisors of RFMOs, and they should take this opportunity to promote a fairer fishery governance; states in favor of the environment may actively use the dispute settlement regime under the Fish Stocks Agreement to invoke the international responsibility of the state members of RFMOs as a whole.

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Article

Incorporation of Fisheries Policy into Regional Blocs?—Lessons from the EU's Common Fisheries Policy

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Abstract: As globalization is facing increasing challenges, regionalization demonstrates the potential to effectively address many transboundary issues. Current international fisheries management has attracted criticisms, among which the poor incentives for countries to attend and comply with the rules are notable. This paper aims to explore whether the incorporation of fisheries policies into regional economic blocs can be a solution to improve cross-border fisheries management. The development, problems, and future of the Common Fisheries Policy (CFP) of the European Union are explored in detail. This paper concludes that the evolution and implementation of the CFP provide some precious lessons for the world. An appropriately designed regional fisheries scheme would help to create incentives for countries to participate in regional regimes and improve their fisheries management. Economic incentives, a good institutional design, and financial and scientific support are critical factors in favor of adopting common fisheries policies under regional economic frameworks.

Keywords: Common Fisheries Policy; cross-border fisheries management; regional blocs; fisheries governance; international cooperation

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1. Introduction

The world is undergoing profound changes. Globalization that has deeply influenced individuals, societies, and the international community is facing increasing challenges and antipathy [1]. Regionalization is characterized by fewer members, closer interaction and connections, and better economic and political security guarantees, which make it easier for States to find common interests. Great potential can be identified to develop regional multilateral approaches, especially with the rise of Asia and the development of less-developed regions [2]. Fisheries issues have been an important topic in international society as they involve environmental, economic, political, and social factors. They also concern biodiversity and ocean sustainability. The economic performance of many coastal countries is in relation to the fisheries industry and the global seafood trade has been lively. It is also a highly sensitive political issue when delimitation of waters and geopolitical factors are involved. In addition, fisheries are also of high social significance as it is directly related to the livelihood of fishers and food supply. Fisheries management needs international cooperation and effective implementation of the related agreements.

Current fisheries management is still fundamentally based on national willingness, ability, and implementation. A dual system has been adopted by the law of the sea: waters within the EEZs are subject to the management and jurisdiction of the coastal States, and high seas are subject to the principle of fishing freedom (although there has been a trend of imposing more restrictions and obligations on States) and joint management. At the international level, the UN (including the FAO) has provided a series of frameworks, principles, regimes, and guidelines to promote the conservation of living resources in the ocean. At the regional level, regional fisheries bodies (RFB), especially regional fisheries management organizations (RFMOs), are playing significant roles in improving cross-border fisheries management. They are organizations dedicated to fisheries management and play a special role in providing data and advice, making decisions based on scientific

assessment, and monitoring in-time changes and implementation. The key problem, however, lies in the incentives of States to participate in and effectively implement the international and regional management schemes [3].

Given the potential of future regionalization and the challenges faced by the current international fisheries management regimes, this paper starts from an idea of whether regional blocs can help to improve the incentives for States to attend and effectively implement cross-border fisheries management. The EU, which has been so far the most successful regionally integrated economy and adopted a Common Fisheries Policy (CFP) at the union level, is taken as an example to examine in detail how and how well it works for adopting fisheries policies within regional economic frameworks. By examining the evolution, problems, and effect of the CFP, this paper provides insight into the EU experience and its possible future. Lastly, an assessment is given, providing an analysis of possible implementation in other regions of the world and lessons that can be learned. The EU is motivated by specific situations (security needs after the wars, benefit of economic integration, wide political, social, and cultural similarities) and requires a radical transformation and centralization of powers [4]. Therefore, it is doubted whether the EU experience can be duplicated by other regions (Africa has been following the EU experience of integration but has had much less success [5]). However, it can still provide some precious lessons. The EU experience has suggested the importance of the linkage of fisheries issues and other economic issues, which creates higher incentives for States to take part in regional management. It also demonstrates the significance of good institutional design, involvement of science, and effective enforcement and monitoring.

2. Background

2.1. From Globalization to Regionalization?

This round of globalization, in some scholars' view, capitalist globalization [6], characterized by inclusion and integration of markets, liberalization and deregulation, growth of transnational corporations, and international division of labor, has been going on for decades [7]. The debate concerning the future of globalization has been fueled especially since the 2000s [8,9]. The 2008 financial crisis happened in the US, which is the world-leading economy and biggest beneficiary of globalization and became a significant event [10]. The world has witnessed an increasingly clear trend of "anti-globalization" since then. The European debt crisis, the following failed European Constitution referendums, and Brexit (failure in regional political agenda), the trade war against China started by the US (market barriers and restrictions on trade), and the worldwide COVID-19 pandemic since 2019 (border control and social isolation) have all significantly contributed to the trend of deglobalization. Scholars from different fields have provided reflections, criticism, and alternatives to globalization. Most of the criticism concentrates on periodical economic crises which may have a worldwide effect, increasing inequality among different countries and different groups of people, unemployment or limited and customized job vacancies in one market, environmental problems, especially in less-developed countries, and the possible increase in social instability [7,11,12]. In particular, with worsened US–China relations and the physical difficulties caused by the pandemic, the fragility of global supply chains has been exposed [13,14]. Academic circles have made efforts to find alternatives or adjusted approaches to globalization for years and regionalization is one of the proposals.

Compared with globalization, regionalization has its own advantages: there is more interaction among countries in the same region and it is easier for individual countries to find common interests [15]. In this regard, regional frameworks are facing fewer difficulties to be developed and guaranteed. Regionalization is not new yet has attracted special attention recently. Some empirical findings have demonstrated the fast development of regional cycles and regional frameworks [16,17]. Similar to globalization, regionalization is a multilateral solution under the current sovereign state-based international governance. Regionalization experienced ups and downs. Söderbaum (2016) identified two waves of regionalization as the "old" and "new" regionalization [18]. After the end of World War II,

many regions enjoyed a wave of regionalization under the newly established world order. The primary incentives behind it were protectionist trading schemes and security concerns. He further notes, that from the 1980s, a new wave of regionalization can be identified, which features a "state-led" style instead of natural society integration. Regionalization, driven by technology and transportation development, economic liberalization, and the pursuit of efficiency [19], and the demand for cooperative management of transboundary issues have again faced increasing challenges in the last two decades. The EU experienced significant difficulties pushing further political integration after its enlargement. Regionalization in African, Latin American, East Asian, and Arab countries can hardly be regarded as "successful" as effective regional schemes are insufficient. An eye-catching regional integration was ASEAN, which explored a softer and more flexible style of regionalization compared with the EU [20].

Today, the world confronts complex problems and challenges. One possible reason leading to anti-globalization is the unbalanced movement speed of capital, goods, and humans. Put differently, the social and cultural interactions among States did not keep pace with the removal of market barriers [1]. As the old-style globalization gained widespread criticism, regionalization seemed more attractive. Firstly, technology development and economic efficiency are still encouraging economic integration in the world. Increased cross-border interaction is especially based on the development of communicating technologies, transportation, and other infrastructure. Market integration can improve economic efficiency and unlock regional potential. In the long run, the world has gone through and will continue to experience integration with technology development. Secondly, as the world order is undergoing instability and changes, States have a higher self-protection demand. The pandemic not only exposed the danger of long and widely distributed supply chains but also further triggered nationalism all over the world [13]. Protectionism may revive. However, with decades of globalization, this time, protectionism may not limit its scope strictly within national borders but rather be influenced by regional market integration and political recognition among neighboring countries. Core States may lead to regionalization and develop a regional supply and distribution chain which better fits their national security interest. Thirdly, the regional integration of less-developed countries deserves special attention. The liberal international order established and dominated by Western countries is being damaged. The decline and inability of international organizations such as the World Trade Organization (WTO) is a good example. The once attractive internationalism is facing serious challenges. In contrast, regionalization in some less-developed regions has demonstrated its potential. After several years of failed, rushed, or unsuitable regional regimes in regions such as Africa and Latin America, new progress is expected to be made. For example, in the Asia-Pacific area, the Regional Comprehensive Economic Partnership (RCEP, regional trade bloc concentrating on the removal of market barriers) was concluded, demonstrating the will of the signatory parties to promote regional cooperation. In Africa, the African Continental Free Trade Area (AfCFTA) was founded in 2018, and trading under the agreement commenced in January 2021.

In summary, the world has witnessed increasing challenges to globalization. However, there are still strong incentives for integration and demand for multilateral cooperation. Regionalization has great potential especially in less-developed regions (as technological and infrastructure developments in these regions can make a big difference). The discussion of the issues that need cross-border cooperation and coordination should take this trend into consideration to explore better and more effective solutions.

2.2. Status Quo of the Global Fisheries Management

Fisheries is one of the areas with a special demand for cross-border cooperation. Marine life is moving and sharing the same oceans regardless of boundary delimitation by humans. Fish are common-pool resources that may lead to over-exploitation of coastal States (the tragedy of the commons) and insufficient management (the free-rider problem) [21,22]. Particularly, with the development of vessels, fishing facilities, and skills,

illegal, unreported, and unregulated (IUU) fishing has become a critical issue faced by the international community. Cooperation and institutional guarantee are therefore needed. Various legal instruments have been employed by the international society concerning fisheries management. International agreements can be divided into two categories: hard law and soft law. Treaties signed and ratified by States are legally binding and States are responsible for the breach of them. Soft law, such as guidelines, declarations, plans, etc., has no legally binding force. States can voluntarily follow the norms to promote their practice and reputation.

The United Nations (UN) has established a regime mainly based on two treaties to protect fish stocks. Some principles and general provisions are provided by the United Nations Convention on the Law of the Sea (UNCLOS), a fundamental legal framework concerning maritime issues, especially Articles 61–68, 116–120, 197 of the Convention. A distinction between the EEZ and high seas is adopted. Within the EEZ, the coastal States have exclusive rights and jurisdiction concerning fisheries issues. On the high seas, freedom is respected. States have the obligation to cooperate and take measures to conserve living resources (however, UNCLOS provides neither additional binding standards for measuring the outcomes nor monitoring mechanisms, and therefore, the implementation of this general provision basically depends on the signatory parties). The 1995 United Nations Fish Stock Agreement (UNFSA) provides a further legal framework for cooperative management of straddling and highly migratory fish stocks. It is directly linked to UNCLOS but has different signatory members (168 parties have ratified UNCLOS and 91 parties have signed the UNFSA [23]). States are subject to obligations to adopt a precautionary approach and cooperate either directly or through subregional or regional organizations (similar to UNCLOS, it also fails to provide measurable standards for the implementation). The UN legal frameworks, although providing mostly general provisions, laid the foundation for international fisheries management.

The FAO, as a specialized organization, provides more complete and practical regimes. Its main functions are described as "to provide a forum for the development of norms" and to collect, analyze, and disseminate data and information. The FAO has developed several instruments, both legally binding treaties and non-legally binding "soft" instruments. Treaties include the Compliance Agreement (concentrating on duties of the flag States, more than 40 signatory parties) and the Agreement on Port State Measures (70 signatory parties). Soft law instruments (technical guidelines, plans, principles, etc.) include a notable regime, the Code of Conduct for Responsible Fisheries (with a comprehensive, all-embracing, voluntary character), and its four International Plan of Action (IPOAs). Although the soft law instruments have no legally binding force, they have several advantages: easier to conclude and less costly to negotiate, lower "sovereignty costs" on states, more flexibility to deal with uncertainty, creating opportunities for "deeper" cooperation, dealing better with diversity, available to more participants, etc. [24] The FAO plays an important role as a venue for international fisheries management. It has concentrated on providing technical and practical assistance for countries. As to the main challenge of international implementation, its role is limited [25].

At the regional level, international regimes are implemented mainly by regional bodies. If an organization performs an advisory role, they are regional fisheries advisory bodies (RFABs) (Table 1). By providing forums for members, enhancing cooperation among members, providing information and scientific support, developing common strategies and coordination, etc., RFABs can provide important support for the regional management of fisheries [26]. UNCLOS and UNFSA provide the legal basis for the establishment of regional fisheries management organizations (RFMOs), and their functions are highly recognized by FAO documents. Currently, there are around 16 RFMOs developed in different areas of the world (Tables 2 and 3). Some of them are general RFMOs and some of them concentrate on special species (such as tuna, salmon, etc.). Different from RFABs, RFMOs have the power to adopt binding decisions. It often consists of a commission, a secretariat, a scientific committee, and a technical compliance committee. It is no doubt

that RFMOs have significantly contributed to the establishment of international standards, facilitation of international cooperation, providing information and data, and monitoring and performance reviews [27].

Table 1. Some Important RFABs.

APFIC	Asia-Pacific Fishery Commission	1948
ATLAFCO	Ministerial Conference on Fisheries Cooperation among African States Bordering the Atlantic	1989
CECAF	Fishery Committee for the Eastern Central Atlantic	1967
COREP	Regional Commission of Fisheries of Gulf of Guinea	1984
CRFM	Caribbean Regional Fisheries Mechanism	2002
FCWC	Fishery Committee for the West Central Gulf of Guinea	2007
FFA	Pacific Islands Forum Fisheries Agency	1979
NAMMCO	North Atlantic Marine Mammal Commission	1992
SEAFDEC	Southeast Asian Fisheries Development Center	1967
SWIOFC	Southwest Indian Ocean Fisheries Commission	2004
WECAFC	Western Central Atlantic Fishery Commission	1973

Table 2. General RFMOs.

GFCM	General Fisheries Commission for the Mediterranean	1952
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources	1982
NAFO	Northwest Atlantic Fisheries Organization	1979
NEAFC	North-East Atlantic Fisheries Commission	1982
NPFC	North Pacific Fisheries Commission	2015
SEAFO	South-East Atlantic Fisheries Organization	2004
SIOFA	Southern Indian Ocean Fisheries Agreement	2012
SPRFMO	South Pacific Regional Fisheries Management Organization	2012

Table 3. Specialized RFMOs.

CCSBT	Commission for the Conservation of Southern Bluefin Tuna	1994
IATTC	Inter-American Tropical Tuna Commission	1949
ICCAT	International Commission for the Conservation of Atlantic Tunas	1969
IOTC	Indian Ocean Tuna Commission	1998
WCPFC	Western and Central Pacific Fisheries Commission	2004
NASCO	North Atlantic Salmon Conservation Organization	1983
NPAFC	North Pacific Anadromous Fish Commission	1992
CCBSP	Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea	1994

However, RFMOs have also attracted doubt and criticism. Haas et al. summarized some factors influencing the performance of RFMOs. Limited members, lack of compliance and enforcement, and political willingness of States are listed as important factors [28]. Barkin et al. (2013, 2018) pointed out that there is no central authority able to guarantee the enforcement of the binding rules and international fisheries management depends on collective action among states. RFMOs are described as a "micro-regulation", which set total allowable catches that sometimes exceed the scientifically advised amount; and even these allowances are not facing non-compliance by members. It may cause the "balloon problem", where fishers change their regions or species to continue their overfishing. They further proposed to establish a global macro-level regulator and an international fisheries policy [29,30]. The political willingness of the RFMO members has been questioned [31], not to say the States that have not yet participated in RFMOs. Obviously, RFMOs need to be improved and should play more important roles in regions.

Summing up, the current international fisheries management system, a dual system based on the distinction of EEZs and high seas and supplemented by specialized regional management organizations, is confronting various problems. Firstly, State activities within EEZs are difficult to regulate as international treaties only provide general principles and neither measurable standards nor binding monitoring mechanisms are provided. Secondly, on the high seas, legally binding decisions are provided by RFMOs, which face deficits such as limited membership and non-compliance. As cross-border management and international issues are relying on the participation and implementation of States, incentives and willingness are the keys to promoting cross-border management.

2.3. Fisheries Policy within the Framework of Regional Blocs: What Merits?

Regional regimes established under the current international fisheries management frameworks are mostly specialized and fragmented: States can decide which regimes to participate in and their implementation largely depends on their own will. Therefore, the key problem can be identified as promoting the incentives for States to participate in and effectively implement cross-border fisheries management. Barkin et al. (2013) proposed to establish a global and centralized regime. Under the background of anti-globalization and the changing international order at present, it is harder to be realized. Regional fisheries policies provide an alternative approach, and three merits can be identified.

Firstly, regional fisheries policy within economic blocs can set up linkages among fisheries and other issues and promote economic incentives for States to participate in regional regimes. Under the current framework, whether to attend a binding multilateral regime and follow the rules or standards set up by the regime is still based on States' willingness. Fisheries can be a sensitive issue for coastal States. Effective fisheries management is supported from a long-term and community interests perspective. From a short-run (which may be related to domestic politics, for example, term of office) and individual States' (the free-rider problem) perspective, effective fisheries management may not be the optimal choice for a government. Although the international community is increasingly forming an atmosphere that environmental protection and conservation of marine life are important, how deep can this moral obligation influence the decision of a government is doubtful. In addition, different countries may have different core concerns. The issue of fisheries management then may create space for negotiation and gain exchange. The incorporation of fisheries management into regional blocs will help to link different issues. Potential economic benefits (for example, possible development after joining a big market) can be an effective way to remedy the deficit of RFMOs concerning the limited members.

Secondly, regional blocs help to provide a compliance and enforcement guarantee. Although RFMOs provide legally binding decisions such as quotas, their ability to ensure the compliance and enforcement of the Member States is widely doubted [25]. Besides, fisheries management within the EEZs of the coastal States is not covered by the RFMOs. Regional fisheries policies, on the other hand, may cover a wider scope of management and set up higher standards. The increased measurability of fisheries measures and monitoring mechanisms can help to promote the effectiveness and efficiency of fisheries management. In addition, in most regional blocs, there are more available mechanisms for enforcement and disputes settlement. For example, the EU provided regional level enforcement institutions (mostly the Commission) and judicial institutions (EU courts) to guarantee the implementation of regional policies, which is discussed in detail in the next section. Another example is the "ASEAN way", which is also adopted by the RCEP. Consultations and participation of third parties are introduced, as well as panel proceedings [32]. It is also worth noting that incorporating the fisheries policy into regional blocs itself can contribute to the improvement of the binding force concerning regional fisheries management. The increased regional integration and States' consideration of their long-term reputation all contribute to States' incentives to follow the decisions of the regional regimes.

Thirdly, the incorporation of fisheries management into the regional blocs helps the competent authorities of the Member States to gain technological and financial support.

Good fisheries management depends not only on the willingness of a State but also on the capability of the competent authorities. Fisheries management is not costless. In contrast, good fisheries management demands solid technological and financial support to collect, analyze, and allocate data, conduct scientific research, and effectively enforce the law. Regional fisheries policy may generate "economies of scale". For example, the regional approach is regarded as beneficial for ocean governance in the Pacific Islands, especially concerning investment and costs, capacity building, policy formulation, and international influence [33]. Better cooperation and coordination can improve the efficiency of resource utilization. It is particularly important for less-developed regions or unbalanced-developed regions.

In brief, the merits of the adoption of regional fisheries policies under regional economic frameworks mainly include increasing incentives and capabilities of States and their domestic authorities to access regional regimes and comply with the related standards or rules.

3. The EU's Common Fisheries Policy: A Case Study

The EU has been the most successful regional regime so far in the world. It has experienced over 60 years of integration, developed from economic integration to political and social integration. African, Latin American, and Asian countries have all learned from their experience concerning regional cooperation and coordination. Although it confronts significant problems further advancing the agendas on political and security issues, its experience dealing with cross-border issues still deserves special attention. Fisheries management has been a Union-level issue. A series of legislation and institutes have been established, providing a good example for examining the effect of adopting a common fisheries policy in a regional framework.

3.1. Development of the CFP

The CFP has experienced a gradual development. In 1970, two regulations (Regulations No. 2141/70 [34] and 2142/70 [35]) were passed, laying the foundation for the CFP (on the common structural policy and the common organization of the market) [36]. The dominant idea at that time was that fish resources were sufficient and therefore, although concerns about overfishing were mentioned, the focus of the rules was more put on water access, inter-state reciprocity, fishing allocation, and productivity increase [37]. The Regulations provided general provisions calling for the Community to form common rules and granted the Council to take measures "where there is risk of overfishing [38]". Member States were required by the Regulation to ensure equal treatment and notify and coordinate with each other concerning fishing issues. The CFP was completely established in 1983 when Regulation No. 170/83 [39] was adopted by the Council. A scheme was established, and a set of instruments based on total allowable catches (TACs) and quotas limiting the fishing effort were developed. It was proposed that the objective of the Community system is to ensure the protection of fishing grounds, the conservation of biological resources, and the long-lasting balanced exploitation of resources [40]. Since then, around every ten years, a significant reform concerning the CFP has been introduced. The CFP has been consolidated with several amendments concentrating on fisheries management and structural support in the following years.

In 1992, Regulation No. 3760/92 was adopted, in which fishing licenses were introduced. The Council was granted the competence to establish and update management objectives and management strategies. It also gained the power to determine the total allowable catch/fishing effort and distribute the fishing opportunities among the Member States. The Council was responsible for installing an EU-level control system [41]. In 2002, after realizing that fish stocks were decreasing at an even faster rate, the EU introduced three regulations: No. 2371/2002 [42] (Framework Regulation), No. 2369/2002 [43] (regarding Community structural assistance in the fisheries sector), and No. 2370/2002 [44] (concerning emergency Community measure for scrapping fishing vessels). A long-term

and precautionary approach was developed by this reform, emphasizing sustainable exploitation of marine resources in environmental, economic, and social terms, which takes into consideration not only the fragile marine ecosystem but also stakeholders such as fishermen, fishing industry, and consumers [45]. The roles and voices of fishermen, experts (providing scientific, technical, and economic advice), consumers, and representatives of different sectors were stressed through the establishment of the Regional Advisory Councils (RACs). Compared with the former Regulations, the 2002 reform enlarged the scope of the CFP, highlighting the principles of "good governance [46]", and specifying many rules concerning measures and enforcement. A more organized system was established with a clearer scientific basis, a better involvement of stakeholders, an increasing consideration of long-term plans, and a clearer division of responsibilities between the EU, national and regional levels [47,48].

In 2013, identifying some problems which had not been noticed before, the EU carried out another reform concerning its fisheries policy. Three pillars, including the regulations concerning Common Fisheries Policy (Regulation No. 1380/2013 [49]), the common organization of the markets (Regulation No. 1379/2013 [50]), and the European Maritime and Fisheries Fund (Regulation No. 508/2014 [51]), are supporting the current EU fisheries regime [40]. It is based on the 2013 Regulation with an amendment made in 2019. The 2013 reform introduced the principles of the maximum sustainable yield (MSY) [52]. It adjusted the emphasis of the CFP's management of fish stocks from avoiding stock collapse to maximizing long-term yield. Markus et al. summarized several points about how it provides a more measurable, comparable, and sustainable approach concerning fish stocks [53]. The updated system encourages more quantifiable targets. In order to control the waste of marine biological resources, a discard ban was developed. An obligation to land catches on a fisheries-by-fisheries basis was stipulated with a specific timetable for different waters and the general landing obligation is not applicable (Article 15). In addition, more flexibility was introduced. For example, Member States can decide whether to use the year-to-year flexibility of up to 10% of the permitted landings (Article 15(9)) and choose to establish a system of transferable fishing concessions (Article 21). Generally speaking, existing CFP concentrates more on the concept of sustainability, quantifiability, and incentives of stakeholders. Table 4 briefly demonstrates the development of the CFP.

Table 4. Development of the CFP.

Development	Important Regulation No.	Key Instruments Introduced
Creation of the CFP (1970–1983)	2141/70; 170/83	TACs, quotas, technical measures
1992 Reform	3760/1992	Fishing licenses
2002 Reform	2371/2002	Multi-annual framework, management, and recovery plans, strengthened technical measures
2013 Reform	1380/2013	Multi-annual multi-species and fisheries plans, maximum sustainable yield (MSY), discard ban

Source: EUR-Lex.

3.2. Legal Basis and Institutions

The EU was established on a series of Treaties among the Member States. The founding Treaties include the Treaty of Paris (1951) [54], the Euratom Treaty (1957) [55], the Treaty of Rome (1957) [56], and the Treaty on European Union (TEU, 1992) [57]. Currently, the TEU and the Treaty on the Functioning of the European Union (TFEU) form the constitutional basis for the European Union [58]. The legitimacy of the CFP was questioned at the beginning as an authority to regulate fishing issues and was not explicitly granted to the European Economic Community (the EEC, now replaced by the EU) institutions by the Treaty of Rome. However, Article 38 of the Treaty provided that 'the common market shall extend to agriculture and trade in agricultural products', which includes 'the products of

the soil, of stock-farming and of fisheries . . . ' and that 'the operation and development of the common market for agricultural products must be accompanied by the establishment of a common agricultural policy among the Member States'. Later, with the amendment of Article 3 of the TEU, the competence of adopting the CFP was explicitly given to the EU, reading 'the activities of the Community shall include . . . (e) a common policy in the sphere of agriculture and fisheries'. At present, except for Article 3 of the TEU, the legal basis for the EU to adopt a CFP also includes Articles 3–4 and Articles 38–43 of the TFEU. Exclusive competence was granted to the EU concerning the conservation of marine biological resources and shared competence was given to the EU and the Member States concerning the fisheries issues other than the conservation of marine biological resources. The EU possesses the power to define, implement, and monitor the enforcement of the CFP, and EU Institutions undertake the responsibilities to make and implement the CFP [42].

It is worth noting that the enlargement of the EU has played an important role during the development of the CFP. In 1972, when the UK, Denmark, Ireland, and Norway sought to participate in the European Community (the EC, now replaced by the EU), the legal basis that applicants shall follow the fisheries policy of the community was established. In the 1972 Treaty of Accession [59], the four applicants authorized the community to restrict fishing in waters under their sovereignty or jurisdiction, and from the sixth year after accession, the Council was authorized to determine conditions for fishing [60]. The EU Court recognized the exclusive competence of the EC to adopt conservation measures for Community waters in Commission v. United Kingdom, claiming that "the transfer to the Community of powers . . . being total and definitive, such a failure to act (of the EC) could not in any case restore to the Member States the power and freedom to act unilaterally . . . " [61]. The establishment of a legal basis is very important for the formation and development of a regional fisheries policy. In the EU, both Treaties and Court rulings consolidate the CFP's legal basis.

The CFP is based on "a vast mass of legislation" covering most aspects of the industry [42]. The EU has developed a complete, systematic fisheries policy framework [62]. Both EU institutions and the Member States are playing important roles in it, collectively or individually [63]. The CFP is an exclusive competence of the EU and the legislation normally takes the form of regulations. The Commission performs as an initiator and facilitator of the legislation and is responsible for negotiating with third States. It plays an important role in financial assistance and administrative work. It is also responsible for monitoring and guaranteeing the implementation of the CFP. It receives advice from the Advisory Councils (ACs) [64,65] and the Scientific, Technical, and Economic Committee for Fisheries (STECF) [66]. If there are serious threats that require immediate action, the Commission can adopt temporary measures. The Council performs as the main policy adopter, deciding the development of the CFP and the conclusion of treaties with third States. EU Parliament performs as a co-legislator with the Council on most issues, except that the authority to adopt and allocate the catch limitations solely belongs to the Council. The Council and the Parliament have to go through a negotiation process and jointly adopt regulations in relation to fisheries. The Court of Justice of the European Union, as the supranational judicial institution, made critical judgments on the competence of the EU and the Member States, especially between 1976 and 1983 [67]. It is responsible for interpreting the legislation and determining whether the legislation is followed. Member States hold voting rights in the Council. They are responsible for decision making on some matters where certain powers were delegated by the EU [68] and they are also enforcers of the CFP. Fishing opportunities are allocated to the Member States and as long as the quota determined at the EU level is not exceeded, the implementation is to be conducted at the national level and EU institutions do not have the power to act on behalf of the Member States [69] (p. 740). In terms of monitoring and inspection, a European Fisheries Control Agency (EFCA) was established in accordance with Council Regulation No. 768/2005 [70]. Its primary role is to organize coordination and cooperation between national control and inspection activities. Figure 1 below shows the EU Institutions in relation to the CFP.

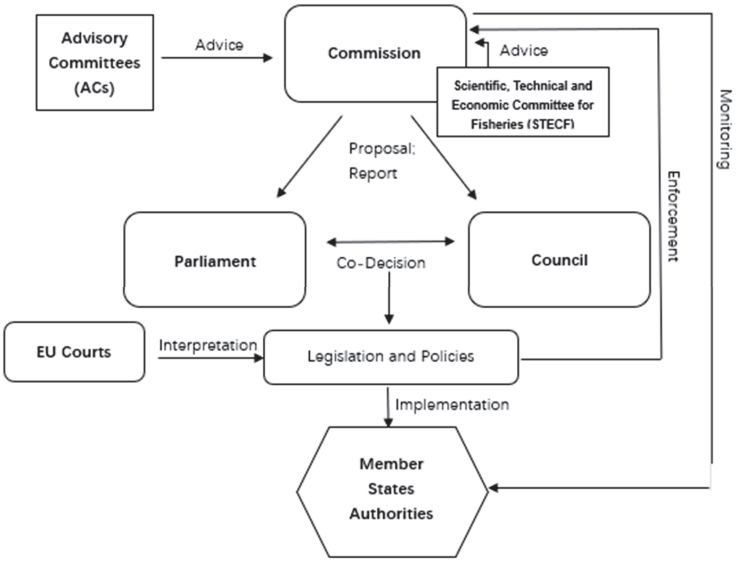

Figure 1. EU Fisheries Management Scheme. Source: Regulation (EU) No. 1380/2013, Luchman (2008) [71].

3.3. Measures Adopted in the CFP

A fisheries management scheme includes complicated institutional, economic, and social factors. In addition to appropriately designed fisheries plans, the effectiveness of a fisheries policy largely depends on the measures adopted by it. Pope (2009) provides a picture of the available measures [72]. The measure can be classified into measures controlling fleet and gears, limitation of access to the fishing ground, and input and output control. Input control (effort management) includes ex-ante instruments which regulate fishing effort. It has the advantages of being measurable and anticipatable, but because of the rapid development of technology, input control must be revised timely. Output control (catch management) includes ex-post instruments which regulate the number of fish that can be taken out of the water. Output control provides clear instructions for fishers and better protection for individual species. Possible problems with it are non-compliance and difficulties to provide an adequate scientific assessment.

In the CFP, measures are incorporated into multiannual plans, which take into consideration both single species and the whole marine ecosystem. Specific measures include technical measures concerning fishing gear, input control such as the limitation on fishing activities in certain areas or periods, and output control such as the limitation on the catch of species and sizes are stipulated. An interesting observation provided by Bellido et al. (2020) is about the regional differences between diverse regions in the EU. While fisheries in the Baltic are relatively simple and concern both fish species (three main species: herring, sprat, and cod) and fishing patterns (relatively small fleet and similar gears), the Mediterranean presents a high diversity of both. It has been noted that a good degree of compliance is better than an extensive framework which may lead to higher non-compliance. Consequently, in the Baltic Sea, output measures play an important role as it is easier for them to be enforced and in the Mediterranean, input measures are mainly used. They concluded that, therefore, even with a regional fisheries policy that establishes an institutional framework to guarantee an appropriate design of cross-border fisheries policy, better cooperation and coordination between different States, and a monitoring mechanism for the implementation of the policy, regionalized and adapted management measures are still very important [73]. The establishment of regional fisheries policy must pay special attention to the balance between the centralization and regionalization of fisheries management.

3.4. Criticism and Future of the CFP

The CFP is developed with criticisms and adjustments. Individuals, industry, and politicians have blamed the CFP for neither preventing the depletion of fish stocks in EU waters nor maintaining the traditional coastal communities [31] (p. 6). In the 2009 Green Paper on the reform of the CFP, the EU Commission examined the outcomes of the 2002 CFP reform and concluded that "the objectives agreed in 2002 to achieve sustainable fisheries have not been met overall [74]". It reported that most fish stocks have been fished down, with 88% of stocks being fished beyond MSY and 30% outside safe biological limits. It identified five failures of the CFP that needed to be improved: a deep-rooted problem of fleet overcapacity, imprecise policy objectives, a decision-making system encouraging a short-term focus, a framework that failed to assign sufficient responsibility to the industry, and poor compliance by the industry.

The CFP has also attracted criticism and assessment from academia. The CFP was criticized especially concerning the following four problems: the control of overfishing, the incorporation and implementation of scientific advice, the enforcement of the CFP, and the participation of stakeholders. In terms of overfishing, before the introduction of MSY in 2013, an average of 59.7% of the TACs adopted by the EU was criticized as higher than those advised by the scientists [75] and the CFP failed to control excessive quotas to remedy the common pool nature of fish stocks and the inter-temporal management problem associated with fisheries [76]. In addition, the CFP did not prevent the States to pay subsidies to fishermen to support their domestic industry [69]. In terms of scientific advice, a complicated political process was regarded as having impeded the EU from effectively adopting scientific advice [77]. Several political deficiencies contributed to this problem, for example, pressure from the stakeholders who are unwilling to bear the costs of reducing catches, shortcomings associated with the electoral politics, and political devaluation of fisheries science, etc. [72]. The CFP was also criticized for experiencing insufficient enforcement. Although the CFP is an exclusive competence of the Union, enforcement of it relies on both EU institutions and national authorities. An important weakness of the CFP identified is the poor enforcement of the Member States concerning fisheries management [78,79]. Strong resistance to reform of the CFP also increased the difficulties of improving the management system [80]. As to the stakeholders, collusion between the fisheries industry and advisers is one important factor leading to the lack of success of the CFP [81]. The ACs are dominated by the fisheries industries and many other interest groups have less influence on AC recommendations [82]. Strong lobbies in favor of the fisheries industry and transparency problems existing in both management measures and the decision-making process may lead to less inclusion of stakeholders [76].

The reforms of the CFP have responded to criticisms. The principle of "good governance" is stipulated in a more detailed manner in the 2013 Regulation [83], which identified the shortcomings of the old CFP and the directions of the future CFP. It provides that,

> The CFP shall be guided by the following principles of good governance:
>
> (a) the **clear definition of responsibilities** at the Union, regional, national, and local levels;
> (b) the taking into account of regional specificities, through **a regionalized approach**;
> (c) the establishment of measures in accordance with the best available **scientific advice**;
> (d) a long-term perspective;
> (e) administrative cost efficiency;
> (f) appropriate **involvement of stakeholders**, in particular the Advisory Council, at all stages—from conception to implementation of the measures;
> (g) the primary responsibility of the flag State;
> (h) **consistency** with other Union policies;
> (i) the use of **impact assessments** as appropriate;
> (j) coherence between the internal and external dimensions of the CFP
> (k) **transparency of data handling** in accordance with existing legal requirements, with due respect to private life, the protection of personal data, and confidentiality rules;

availability of data to the appropriate scientific bodies, other bodies with a scientific or management interest, and other defined end-users.

The outcomes of the reformed CFP and further reforms are awaiting future observation. Some data, however, have already demonstrated a positive trend. In the report issued by the EU STECF in 2020 [84], from 2003 to 2018, the number of stocks where fishing mortality exceeded the scientifically calculated maximum fishing pressure (FMSY) has experienced a drop from 45 to 26 while the number of stocks where fishing mortality was equal to or less than FMSY has doubled from 18 to 42. The number of stocks outside safe biological limits has decreased from 31 to 14, while the number of stocks inside safe biological limits has increased from 13 to 30. In addition, an increase in the biomass of some stocks has also occurred. The data demonstrate a better sustainability of fisheries in the EU, while the performance does not change that much in other parts of the world. These figures present a positive outcome of the CFP. The CFP has also received some positive feedback from academia. Belschner examined the CFP based on 17 evaluation criteria in five dimensions (ecological, economic, social, good governance, and evidence) in 2019. Except for five criteria, namely, simplicity of rules, user-pays principle, resource efficiency, accountability, and compliance mechanisms, the CFP either works well or shows a positive trend regarding all other criteria [85].

Currently, both scholars and practitioners are engaged in exploring a better CFP. Attention is particularly devoted to the following points: (1) the mechanisms concerning the fishing rights such as individual transferable quotas (ITQs) [86]; (2) stakeholder participation and balance between interest groups [66,87–91]; (3) integration and utilization of multiple sources of knowledge such as policymakers, scientists, and stakeholders based on an ecosystem approach [92]; (4) a framework incorporating fisheries into the management of the whole marine ecological systems [93]; and, (5) regionalization and multi-level governance of the fisheries; put differently, co-management and shared-enforcement of the CFP [57,94].

4. Lessons Learned: Pursuing a More Effective Cross-Border Fisheries Management

What lessons can be learned from the EU's experience of fisheries management? Different people may have different opinions. Some people may question the effectiveness of the CFP and some may question whether the EU experience can be applied in other regions). It is well acknowledged that the regional integration of the EU cannot be simply duplicated by other regions considering different regions are facing different conditions and challenges. The CFP was formed and developed in the process of creating and developing a supra-national regional organization (the EU). States authorized (part of) their legislative, administrative, and judicial powers to EU institutes. A harmonized Union-level fisheries policy and a centralized implementation system were created. In the near future, it will be hard to find another region having the same motivation and ability to create a similar supra-national regional organization. However, observing the 50-year evolution of the EU fisheries policy, some precious lessons can still be identified.

4.1. Finding the Economic Common Interests

The CFP was formed when the EU integration was promising and attractive. Although not all Member States were happy with the CFP and had to give up some important powers to the EU (exclusive power of the EU concerning the conservation of living resources), possible benefits of an integrated market prevailed. States still had the willingness to access and be bound by EU law. Linkage of fisheries with other issues through the regional economic blocs is an important factor leading to the success of the CFP. The EU not only provides a framework to link fisheries issues with other important issues but also provides a forum for the Member States to negotiate and make compromises on different interests in a practical way. The potential benefit of regional integration and welfare improvement (especially to less-developed countries) is very appealing, so the high-standard requirements and the loss of some powers are acceptable to countries willing to access the EU. Today,

with environmental protection and conservation of living resources becoming increasingly important, how to generate States' incentives to work cooperatively on common issues faced by the international community is worth noting. Introducing an outer or higher-level authority may help to remedy the short-run deficit of individual governments. Special attention should be imposed on the establishment and improvement of regional regimes, especially finding common interests to promote effectiveness and efficiency.

The CFP has gone through a gradual formation and development. In the beginning, it started with a limited number of parties, an emphasis on equal access to waters, and common interests among members. General and vague provisions were provided, which helped set up a common consensus. Later, more complementary and detailed provisions adopting a long-term and sustainable approach were developed. The competence and responsibility of the institutions were gradually clarified, the scope of the CFP was expanded, clearer objectives were provided, more instruments were introduced, and better decision-making and enforcement mechanisms were developed. Evolving together with international law and the world's latest research concerning fisheries, the CFP provided a good regime connecting the most advanced works with the fisheries management in the EU. It can be learned that a step-by-step approach should be advocated. The first step is always the hardest and a too ambitious goal will affect the motivation of participants and the effectiveness of the regime. By finding common interests and fostering further common interests, regional regimes can become more detailed and enforceable.

4.2. Institutional Design for Better Enforcement

It has been mentioned that regional blocs can provide compliance and dispute resolution mechanisms for members and therefore guarantee the enforcement of regional policies. The effectiveness of a policy depends on its enforcement. The good design of related institutes is important. In the EU, there are clear rules concerning the competence, decision-making process, and responsibilities of the institutes. A complementary set of institutes, including the decision-making authorities, administrative and monitoring authorities, and scientific advisory authorities, are developed, helping to promote the implementation of the CFP. Moreover, the Courts not only provide interpretation for the legal basis of the CFP but also provide a judicial remedy for all Member States.

However, it is notable that institutional design is never easy [95]. The structural establishment of fisheries management in the EU followed a trend of decentralization–centralization–regionalization. The CFP has followed a top-down approach since its establishment in 1983 when the competition was exclusively granted to the EU and the authority was generally centralized. However, with the language of the policy being more detailed and inclusive, institutions and enforcement must find a balance between robust and flexible [96]. Currently, the EU has adopted a system in which the EU institutions make the policy and monitor its application, while Member States are largely counted on to enforce the CFP. The recent works concerning the CFP have paid more attention to the "moving down" (decentralization) and "moving out" (involvement of stakeholders) [97]. Nevertheless, if there never was "centralization", there would never have been "decentralization". The primary task of the CFP is to find a balance between centralization (higher-level force for insufficient national fisheries management) and localization (optimal choices based on local conditions). For other regions in the world, regional institutional design and allocation of powers have to be based on specific economic, political, and environmental conditions in those regions. A general approach is that an efficient system of institutions should be established with a balance of certain centralized competence and regionalized participation.

4.3. Financial Support, Scientific Advice, and Quantification

A clear trend demonstrated by the CFP is the increasing emphasis on scientific advice and quantification. An important way of ensuring the compliance and effectiveness of enforcement is providing measurable standards based on scientific advice. Regarding the

CFP, administrative work, including financial support and monitoring of enforcement, is conducted by the EU Commission, and several scientific organizations are established to serve the decision making and implementation. Fisheries cover a combination of natural science and socio-economic science. Effective management of fisheries requires good skills and scientific support, which are less accessible to less-developed countries. Within a regional economic bloc, resources can be gathered and better allocated, creating scientific and financial support for the weaker members. Through the European Maritime and Fisheries Fund (EMFF), the EU provides financial support for the implementation of maritime policies (it is jointly managed by the EU Commission and the Member States) [98]. In the 2013 reform, the CFP set obligations for the Member States to timely collect and make data available [99]. Through the ACs and STECF, the EU collected, analyzed, and allocated data and information. It also provided good practice for members to follow. This financial and technological support helps to promote the capacity of national authorities, especially of the poorer Member States. The lesson that can be learned by other regions is that pooling the resources and making efficient use of them is very important.

5. Discussion and Concluding Remarks

Fisheries management is critical to many economic and social structures: fishermen, associated industries, physical environment, policymakers, monitors, etc. This paper is inspired by observations of anti-globalization and the potential of regionalization, as well as the current unsatisfactory international fisheries management schemes, especially the RFMOs. Many scholars have devoted their attention to the drawbacks of the current regional fisheries schemes [29–31], among which the incentive issue is particularly crucial, both for attracting States to participate in regional fisheries management and for guaranteeing an effective implementation of regional policies. Can the existing RFMOs make further efforts and encourage regional fisheries management in a more efficient way? Maybe, but the specialized characteristic of the RFMOs set an inherent limit for their ability to be more appealing, especially considering fisheries management requires capacity building, investment, and technological development. Put differently, the costs of participating in RFMOs are high and foreseeable, while the benefits may be uncertain and invisible (the free-rider problem). Therefore, regional fisheries management needs to be combined with more economic motivations. The idea then arises: what about combining the fisheries policy and the regional economic integration?

There is a good example that has gained 50 years of experience: the EU. Theoretically, the incorporation of fisheries management into regional economic blocs can help to establish issue linkage and improve incentives for States to take part in, guarantee the compliance and enforcement of the members, and improve technological and financial support for competent authorities. The EU's experience with the CFP has proved this. The CFP adopted under the EU framework has helped to improve economic incentives by linking different issues, promoted compliance and enforcement by providing an institutional guarantee, and provided better scientific and financial support by pooling resources. No doubt, there is still significant room for improvement for the CFP, especially concerning decision making (incorporation of scientific advice), the balance between centralization and localization, and effective implementation. It is also well recognized that the EU experience may not be suitable for other regions in the world. For example, the EU institutes enjoy powers authorized by the Member States and good financial conditions. In addition, the importance of the conservation of marine life has been widely accepted by the EU people. These conditions are not ready for many other regions. Nevertheless, it is notable that the evolution of the CFP is not accomplished in one move. Considering the potential economic integration and regionalization in Asia, Africa, and Latin America, exploring the incorporation of fisheries management into a complementing regional economic bloc is significant. In this process, economic incentives, good design of institutes, and scientific and financial support are always important aspects.

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The North Sea and Svalbard Fisheries Management Regimes in the Context of Brexit: Divergence and Implications

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Abstract: The North Sea fishery has maintained sound and stable cooperative management over the past four decades. European Union (EU) countries exchange quotas with Norway for fish stocks in their respective fisheries jurisdictions within the framework of the EU Common Fisheries Policy (EU CFP) and the Agreement on Fisheries between the European Economic Community and the Kingdom of Norway. After beginning the Brexit process with a concomitant transitional arrangement, the United Kingdom remained in the EU CFP until the end of 2020. From 2021 onward, the United Kingdom became a completely independent coastal state outside the EU CFP framework. In this context, the long-standing and stable fisheries access and quota exchange system between Norway and the EU will face tensions. The differences among the United Kingdom, the EU and Norway in fisheries also involve quotas and access to the Svalbard Protection Zone. Norway even intends to expand the fisheries conflict to the Arctic Council. To prevent the adverse consequences of conflict spillover and to achieve sustainable development of fisheries and win–win cooperation in fisheries management, the United Kingdom, the EU and Norway launched a series of actions on fisheries issues. In tripartite negotiations, each party has its advantages. Ultimately, win–win cooperation in the fisheries game is the three parties' expected outcome.

Keywords: North Sea; fisheries management; EU Common Fisheries Policy; quota system; fisheries agreement; Svalbard Fisheries Protection Zone

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1. Introduction

Since the establishment of the European Union (EU) Common Fisheries Policy (CFP) in 1983, the EU has been providing uniform conservation and management of fisheries resources within its member states' exclusive economic zones (EEZs), with quotas allocated to member states. The EU has conducted stable quota exchange through fisheries agreements with third countries, such as Norway. During the last forty years, the North Sea fishery has been well and cooperatively managed under the EU CFP and the Agreement on Fisheries between the European Economic Community and the Kingdom of Norway. In 2019, after the United Kingdom started the Brexit process, it remained in the EU CFP until the end of 2020 as a transitional arrangement. After the end of the transition period, from 2021 onward, the United Kingdom became a completely independent coastal state outside the EU CFP framework, setting its own fisheries policy and managing fisheries activities in its EEZ. In the new context of Brexit, fishing opportunities and quotas in the North Sea and the Svalbard Fisheries Protection Zone (SFPZ) have changed dramatically, and the long-standing and relatively stable system of fisheries access and quota exchange between Norway and the EU is facing new tensions.

Furthermore, Norway even intends to submit the conflict over fisheries to the Arctic Council, which will become a destabilizing factor for the Arctic Council's functioning and the Arctic region's situation. To prevent further adverse consequences of the spillover of the conflict, an agreement on the fisheries issue amongst the United Kingdom, the EU and Norway should be reached as soon as possible. The United Kingdom and Norway

signed the UK–Norway Framework Agreement on Fisheries, which provides for annual negotiations on fisheries access and quotas. The United Kingdom and the EU also signed a trade cooperation agreement (TCA) [1], which includes fisheries. Furthermore, negotiations are underway amongst the United Kingdom, Norway and the EU. To ensure the sustainable development of fisheries and to achieve win–win cooperation in fisheries management, the three parties need to establish a legal framework for fisheries cooperation covering trade as soon as possible.

This paper aims to analyze the substantial impact of Brexit on the fisheries management regime in the North Sea and Svalbard Sea area. With Brexit further changing the already complex relationship among the UK, EU and Norway, the management of fisheries cooperation in the context of Brexit needs to be adjusted accordingly. In addition, this paper looks at Arctic governance, with Brexit exacerbating the precarious state of Arctic governance in recent years, underpinned by the long-standing conflict in the Svalbard Fisheries Management Zone. This paper gives a recent analysis and a unique contribution from these aspects.

2. North Sea Fisheries Management System

The North Sea (as shown in Figure 1) is a marginal sea located in the northeast Atlantic Ocean and is bordered by seven countries: Norway, the United Kingdom, Denmark, Germany, Belgium, the Netherlands and France. The North Sea is rich in fishery resources, and the North Sea fishery is one of the four principal fishing grounds in the world. The North Sea fishery is a significant component of the abovementioned coastal countries' agriculture. Except for Norway, which is not a member of the EU, and the United Kingdom, which left the EU in 2019, the coastal states of the North Sea are all members of the EU and are thus bound by the EU CFP.

Figure 1. Map of the North Sea [2], with permission from Halava, CC BY-SA 3.0, via Wikimedia Commons.

2.1. The European Union Common Fisheries Policy

The EU CFP, established in 1983, is a set of rules used to manage the EU fishing fleet and to protect fish stocks. The EU CFP gives all EU fishing fleets equal access to EU waters and fishing grounds and allows fishermen to compete fairly [3]. The EU CFP also forms the basis for EU cooperation with third countries and regional fisheries management organizations (RFMOs) [4].

Although the United Nations Convention on the Law of the Sea (UNCLOS) [5] was ratified in 1982 and took effect as international law on 16 November 1994, many coastal states, including European countries, had already introduced the 200 nautical mile EEZ regime in 1977. Whereas sovereign rights and other jurisdiction over natural resources in the EEZ are vested in the coastal state, EU coastal countries transfer some of their fisheries management rights in their EEZs to the EU. Therefore, the EEZs of the EU coastal states are considered to be "Union waters," and the fisheries regime is managed by the EU, including the formulation of various fisheries policies and the signing of fisheries agreements with non-EU countries in the name of the EU. Additionally, EU fishermen can fish in any member state's EEZ outside their territorial waters [6]. EU countries retain powers to introduce limited measures that are non-discriminatory (i.e., treating all EU fishermen equally) and necessary for conservation goals [7]. The jurisdiction of the EU CFP is not limited to the North Sea. EU countries' annual catches in Svalbard waters are negotiated bilaterally with Norway, after which the fishing quotas are allocated to EU member states.

Fisheries is a policy area in which the EU has supranational authority under the EU CFP. Under the Treaty of Lisbon [8], the European Commission (EC) has the sole competence to negotiate fisheries agreements with third countries, including fisheries in one another's jurisdictions. The EC participates in negotiations with third countries, such as Norway, establishes quotas and then proposes the final total allowable catch (TAC) for each fish to the EU fisheries ministers on the Council of the EU. Each member state manages its respective national quotas, redistributes its allocated quotas from the EU to nationally registered fishing vessels and issues permits as the basis for the right to catch and land a certain amount of fish each year. EU countries must be responsible for their share of quotas and fisheries licenses [9].

2.1.1. Total Allowable Catch

TAC is an essential tool for fisheries management in the EU and was first established and used in 1983. The TAC is the catch limit, and fishing should be stopped once the TAC is reached. The EC sets the TAC based on scientific advice on the status of fish stocks from advisory bodies such as the International Council for the Exploration of the Sea (ICES) and the EU Scientific, Technical and Economic Committee for Fisheries (STECF). TACs for most stocks are set annually by the fisheries ministers on the council, except for deep-sea stocks, which are set every two years [10].

The stocks managed under the TAC system are either managed by EU countries alone or jointly by the EU and other non-EU countries. Where scientific assessments allow, the EU sets TACs for many exploited fish stocks. For stocks shared and co-managed with non-EU countries, TACs are agreed upon with non-EU countries. For fish stocks not managed under the TAC system, such as seabass in the English Channel, which may account for up to 50% of the fishery's catch, fishing opportunities need to be determined in a somewhat different and sometimes complex system [11].

Generally, fishing opportunities should be determined according to objectives related to maximum sustainable yield (MSY), specifically a precautionary approach to fisheries management. It should be ensured that, in the exploitation of living marine resources, populations of harvested species are restored and maintained above levels capable of producing the MSY. Furthermore, fishing opportunities should be determined by quantifiable objectives, such as fishing mortality and/or spawning stock biomass; timeframes that should take into account economic and social impacts, commensurate with the goals and targets

pursued and the timeframe envisaged; and geographic scales, which require the application of knowledge about the interactions between fish stocks and marine ecosystems [12].

Fishing opportunities are determined based on two access regulations: fishing quantity (output) and fishing intensity (input). The intensity includes spatial and temporal components, such as the number of days at sea dedicated to an activity in a given area. Fishing opportunities are determined, to some extent, by historical rights, i.e., the fishing status of each country prior to the establishment of the EU CFP [11].

After the 2013 EU CFP reform, MSY was the primary management objective. In response to the focus on fish resource management, the reform shifted the objective from the minimum requirement of avoiding fish stock collapse to increasing long-term production [13]. To achieve the MSY, the EU CFP has established many regulatory tools in terms of allocating fishing opportunities. By 2020, the consideration of the MSY had to be covered in all fish stocks subject to the TAC. MSY aims to maximize catches while achieving the economic and social sustainability of the fisheries sector.

2.1.2. Quota System

The EU member states allocate TACs to national fish quotas using a fixed allocation ratio based on relative stability [14]. EU countries share the TAC in the form of national quotas, and for different fish stocks, each country adopts different allocation ratios. After the TAC is determined, EU countries exchange quotas according to each country's actual situation and needs in order to maximize the economic benefits of each country's fisheries. The exchange of quotas between countries is measured in value, not quantity.

Quota allocations are based primarily on catches from more than forty years ago, referred to as "historical catches," and are primarily based on adult fish [15]. These catches reflect the goals of national fishing fleets at the time and are not based on available fishery resources. As a result of changes in fish distribution due to the expansion of fish stocks [16] and the effects of climate change [17], fishermen are now actually catching more than their allocated quotas, leading to overfishing [18] or discards [19].

In 2013, the EU introduced a "discard ban," also known as a "landing obligation" (LO), as part of its reform of the EU CFP. However, under the current allocation system based on relative stability, quota shares are virtually unrelated to available resources within national jurisdictions. This is a considerable impediment to reducing the incidence of discards. In the case of cod and whitefish in western Scotland, both stocks are in inferior fishing and conservation conditions. Thus, since the early 2000s, the TAC has been set at zero for cod and at the "lowest possible level" for whitefish. Given that these fish are inevitably caught in a mixed benthic fishery, minimal bycatch limits were previously allowed but resulted in high levels of discards. Under the current LO, this could lead to the closure of the fishery, as the TAC would be rapidly depleted [15]. This case reflects the irrational aspect of unclear calculation under the current EU CFP.

Dissatisfaction with the EU CFP was one of the reasons that prompted British fishermen to vote in favor of Brexit. Moreover, criticism of the EU CFP is not limited to the United Kingdom; other EU countries have also pointed out that the EU CFP fails to ensure the sustainability of fish stocks because fishing levels are higher than those which scientific evidence suggests [20].

2.1.3. Policy Area

The EU CFP was originally part of the Common Agricultural Policy (CAP) aimed at "increas[ing] productivity, stabilizing markets, providing a source of healthy food, and ensuring reasonable prices for consumers" [7]. With the development of specific legislation and structural policy changes in the fisheries sector and the increased need to address fisheries issues, the EU CFP became a separate policy area. The EU constructed a new legal framework on fisheries based on the EU CFP.

The CFP has four main policy areas: fisheries management, ensuring the long-term viability of stocks, such as cod, tuna and shrimp in Union waters; international policy and

cooperation, which entail working with non-EU countries and international organizations to manage shared fish stocks, including Norway, Iceland and the Faroe Islands; market and trade policy, which aims to create a level playing field in the market and to set standards for seafood products sold within the EU in order to protect consumers, for example, by requiring clear product labeling; and funding, which secures funds to support the transition of fisheries to more sustainable fishing practices and assist coastal communities in diversifying their economies [21].

2.2. Agreement on Fisheries between the European Economic Community and the Kingdom of Norway (1980 Agreement)

In April 1977, Norway and the EU reached an agreement on five mutually managed shared fish stocks, and quota sharing began in the same year. Since 1977, the North Sea coastal states have cooperated in managing shared fish stocks. In February 1980, Norway and the EC signed the Agreement on Fisheries between the European Economic Community and the Kingdom of Norway (known as the 1980 Agreement) [22], which is still in effect. The 1980 Agreement covers non-jointly managed fisheries stocks, access and quota exchange arrangements, covering the Barents Sea (a marginal sea of the Arctic Ocean) and the North Sea. Norway and the EU conduct annual fisheries consultations and jointly determine the TACs for the six shared stocks, and for non-co-managed stocks, each party determines its own TAC [23].

Under the 1980 Agreement, Norway and the EU have conducted annual fisheries consultations to agree on TAC quotas for shared stocks, quota exchanges and other regulations. The parties are committed to "achieving a mutually satisfactory balance in their reciprocal fisheries regulations" [22], similar to the exchange of quotas among EU countries, which is achieved in terms of value rather than catch [24]. For more than forty years, positive cooperation between Norway and the EU has contributed to the sustainability of the stock and has ensured a stable situation in the North Sea.

2.3. European Economic Area Agreement

Fisheries and trade are closely related. The European Economic Area (EEA) Agreement [25] took effect on 1 January 1994. The EEA's primary purpose is to unite the EU member states and the three EEA European Free Trade Area (EFTA) states (Norway, Iceland and Liechtenstein) to participate in the EU's internal market, remove trade barriers and introduce standard rules for the free movement of goods, people, services and capital. EFTA countries have bilateral agreements with the EU on trade in fishery products. Specific provisions on trade in fishery products are contained in Protocol 9 of the EEA Agreement and are regulated by other specific provisions of the EEA Agreement and by separate bilateral agreements with the EU [26].

Although the EEA Agreement does not include the EU CFP, Norway cooperates closely with the EU through the EEA Agreement in the fisheries sector [27]. In parallel with EEA Agreement negotiations, Norway and the EU held separate discussions on fisheries cooperation, which facilitated the further development of bilateral cooperation based on the 1980 Agreement, leading to a new agreement based on an exchange of letters on 2 May 1992. Regarding trade, Norway was granted a permanent duty-free quota of 27,215,542 kg for products that previously only temporarily qualified as duty-free [23].

Fishery import and export trade is an essential aspect of fisheries management policy. Norway is the world's second-largest seafood exporter, with nearly 60% of seafood exports going to the EU [4], making the EU Norway's most critical market. Moreover, the demand for seafood in EU countries is also increasing yearly, and nearly 68% of the seafood that the countries comprising the EU consume is imported [4]. Furthermore, most of the fish consumed and processed in the United Kingdom is imported. However, the majority of caught fish is exported. The United Kingdom exports about 80% of its annual catch, 66% of which goes to the 27 EU member states [28]. The importance of the EU market to the UK fishing industry is self-explanatory. The dependence of the British fishing industry on the

EU market and the EU's significant advantages in trade could help the EU fight for more fish quotas. Otherwise, the United Kingdom could incur retaliatory tariffs and other trade restrictions from the EU [23].

Tariffs are an essential factor affecting trade. Under Protocol 9 of the EEA Agreement and other bilateral agreements, Norway enjoys duty-free trade with the EU for most whitefish products. Protocol 9 also reduced tariffs on many other seafood products but did not reduce tariffs on several essential seafood products, namely shrimp, mackerel, herring, large scallops and Norwegian lobster. For these products, the EU maintains import tariffs that vary depending on the degree of processing. For example, a 2% tariff is imposed on imports of whole fresh salmon, and the tariff on smoked salmon is 13%. Trade in some of these products, including mackerel, shrimp and herring, is subject to various tariff-free quotas established by the EU after it absorbed more member states [4].

3. Impact of Brexit on the United Kingdom, Norway and Europe's Tripartite Fisheries Management System

On 29 March 2019, the United Kingdom announced its departure from the EU. Although the fishing industry accounts for only a small part of the United Kingdom's total economic output, it was one of the critical issues in the Brexit negotiations [29].

Before the United Kingdom left the EU, its fisheries management system was governed by the EU CFP. However, this policy has long been criticized in the United Kingdom. Evidence from surveys collected before the Brexit referendum shows that 92% of UK fishermen intended to vote to leave the EU, believing that Brexit would improve the current state of the UK fishing industry to some extent or even significantly [30,31]. The EU CFP was criticized because UK fishermen felt that the quota allocation was unfair to the United Kingdom and that the TAC was set at a higher level than scientifically recommended, failing to ensure the sustainability of the stock.

To give the UK government time to organize its fisheries policy and to address the multiple challenges posed by Brexit [29], the United Kingdom remained in the EU CFP (including the quota system) until the end of 2020 as a transitional arrangement. After the transition period, from 2021 onward, the United Kingdom became free from the EU CFP as a completely independent coastal state outside the EU CFP framework, with the latitude to formulate its own fisheries policy and to manage fisheries activities in its EEZ. Given the United Kingdom's long-standing status and historical practice as a global maritime power, updating its fisheries policy as an independent coastal state will impact fisheries partners and stakeholders, such as the EU and Norway.

The United Kingdom has a long historical presence in North Sea fisheries. Besides the large quota shared by the United Kingdom in the North Sea [32], the 1980 Agreement also gave Norwegian fishermen access to UK EEZ waters, where fishermen from the EU member states also had the right to fish before the United Kingdom withdrew from the EU CFP. The United Kingdom's departure from the EU CFP could have a knock-on effect on the stability of the North Sea fishery. Therefore, to maintain order and sustainability regarding fisheries management in the North Sea, Norway, the EU and the United Kingdom must revise the 1980 Agreement. Another option is to sign a new trilateral fisheries agreement, through negotiations and consultations, that incorporates the United Kingdom as a new quota-sharing subject of North Sea fisheries.

Brexit also poses challenges for the European single market. The EU's market access commitments to Norway remain in effect. However, because the United Kingdom is no longer a party to the EEA, this change regarding a vital member state constitutes a destabilizing factor in the European single market. It is likely to generate trade barriers, causing losses for fishermen and seafood export processors in exporting countries as well as for consumers in importing countries. The three parties, for whom an orderly Brexit is a common desire, should maintain close dialogue and expeditiously establish a legal framework for fisheries cooperation management that includes trading.

3.1. The United Kingdom's Post-Brexit Fisheries Policy

Although the UNCLOS was not yet in effect when the United Kingdom joined the EC, the UK EEZ had already been established and included in the concept of Union waters. With the gradual establishment of the EU CFP, the United Kingdom ceded some authority regarding managing several fishing stocks within its EEZ to the EC. Withdrawal from the EU and the EU CFP means that the UK EEZ must be re-established outside existing Union waters. With the responsibility of decisions and the management of a fisheries policy returning to the United Kingdom, the United Kingdom will, post-Brexit, become an independent coastal state with complete control over its EEZ, including the North Sea, the English Channel, the Norwegian Sea, the Irish Sea and parts of the West Coast [33].

To achieve its fisheries objectives, the post-Brexit United Kingdom has proposed a new approach to quota calculation, namely the zonal attachment (Za) principle. The EU CFP-based quota system fails to ensure the sustainability of fish stocks and has long met with opposition from UK fishermen. Given significant differences between the estimates based on Za and the current quota shares across all stocks, the United Kingdom advocates allocating quotas based on Za, i.e., quotas or catch shares should correspond to the share of the fish stock biomass present within a country's EEZ [15], whereas the EU-27 sector supports the status quo, arguing that historical fishing patterns should be respected [11]. After the assessment of twelve of the fourteen essential fish stocks, it was found that the valuation of the UK regional attachment was significantly higher than the current quota allocation, and the share allocated to the EU was higher than the regional attachment of the EU stocks [15]. On this basis, the United Kingdom argues that it should be given more quotas in the North Sea. However, Za may be difficult to implement in the short term, as there is a need for both parties to agree on the exact level of the catch of all fishing nations in the UK EEZ [11].

After becoming an independent coastal state since Brexit, the United Kingdom decided to put sustainability at the core of UK fisheries policy and to base fisheries decisions on scientific evidence, the need for which has been supported by scientists, parliamentary committees and the industry [34]. Scientific research has become an international practice and plays an important role in the operation and decision making of regional fisheries management, particularly in determining the status of fish stocks, TACs and the subsequent allocation of national quotas [35]. Cooperation with countries on scientific research can send a broader message to the global scientific community in order to facilitate appropriate streamlining of the process of solving relevant problems and to facilitate the consideration of supra-regional issues from a broader perspective [36], especially for certain jointly managed stocks. The UK government's fisheries white paper commits to the principle of the MSY as well as to decision making guided by scientific evidence, encouraging industry participation in policy development [37]. It also reflects the fact that the UK government has learned from other coastal countries' experiences. This commitment has put sustainability at the core of the UK's fisheries policy. By setting and distributing quotas and formulating regulations on gear and access to fishing grounds, the United Kingdom's fisheries regulatory regime must be readjusted to the new post-Brexit situation [33]. Additionally, UK fisheries management is subject to international law. Under the relevant rules of international law, particularly the 1982 UNCLOS, the United Kingdom must cooperate with other states to manage shared stocks in order to establish a common management framework. The United Kingdom cannot, therefore, unilaterally set its TAC and needs to coordinate with other countries to establish a TAC shared in national quotas [11].

Fisheries is an area where policy has devolved. Brexit not only means that powers have returned from the EU to the United Kingdom but also that some powers have devolved to administrations in the UK in policy areas such as fisheries, agriculture and the environment. It may lead to policy differences among the United Kingdom's decentralized governments, resulting in trade barriers. To coordinate the United Kingdom's devolved administrations and to remove trade barriers, the UK government launched a "common framework" in October 2017 and enacted the UK Internal Market Act in 2020 [38]. The UK government

adopted UK-led governance for its fisheries policy. The devolved governments have the autonomy to implement fisheries management approaches that respect their own realities [37]. The state of fisheries varies across each devolved government. For example, Scotland is dominant in the United Kingdom regarding fleet capacity and catches, has a more significant proportion of larger vessels and relies heavily on pelagic and demersal fisheries. However, the fleets of England and Wales consist primarily of smaller vessels, and fisheries rely heavily on shellfish. The benefit of the UK government's approach is that it allows the devolved governments to take a more active role in developing their fisheries policy in their respective areas [33].

The UK government has stated that it will respect the role of the devolved administrations in managing their fisheries and will implement an approach to fisheries management that is appropriate to their circumstances while, where necessary, maintaining the overall coherence of the UK's fisheries policy after Brexit [37]. However, changes at the EU level are likely to lead to divergence in the UK internal market. Northern Ireland will continue to be bound by EU law in certain areas. The UK Withdrawal from the European Union (Continuity) (Scotland) Bill [39] became law on 31 January 2021. It gave Scottish ministers the power to continue to align with EU rules [40]. During negotiation of the TCA, devolved governments expressed dissatisfaction with the neglect to which they had been subjected, which has laid the groundwork for disagreements. Therefore, the UK government needs to track changes in EU policy, ensure that the devolved governments understand the evolving framework of trade relations with the EU and offer them appropriate opportunities to influence the fisheries management structures established under the TCA [41]. Additionally, the UK's fisheries policy needs to be coherent with international fisheries law. The UK government's fisheries white paper highlights, where necessary, that the United Kingdom will maintain overall coherence of its fisheries policy, mainly to ensure compliance with international obligations [37].

For the United Kingdom, fisheries management fully reflects its post-Brexit governance capacity. There is a need for coordination between various devolved administrations and departments within the governments, particularly those responsible for trade and fishing. Any successful fisheries policy requires carefully balancing diverse interests. Moreover, the post-Brexit UK government needs to solve problems well beyond fisheries management by accounting for political and economic factors [29].

Coordination across the UK government is, therefore, essential. Annual negotiations on fishing at the end of the agreed adjustment period (in June 2026) cannot simply be left to the Department for Environment, Food and Rural Affairs, as they could potentially trigger changes in market access in other parts of the agreement [41]. Additionally, changes in fisheries policy involve intergovernmental arrangements for quota management, license holding and the issuance of catch certifications [21]. Demands on the government's ability to coordinate the arrangements are high. Previously, as a member of the EU and a participant in the EU CFP, substantive decision making on UK fisheries policy was undertaken at the EU level, which meant that the roles of the UK government and the fisheries sector were essential to implement policy. Despite having limited discretion in some areas, their capacity and experience to develop fisheries policy autonomously are very limited [33]. Hence, the expansion of fisheries jurisdictional powers and the widening scope of those powers represent a considerable challenge for the UK government while creating uncertainty about the future of UK fisheries.

It is also worth noting that Scotland is a significant player in the fishing industry, and it is, therefore, vital to listen to the Scottish when developing fisheries policies. Data show that approximately 93% of Norway's catches in the UK region between 2011 and 2016 were taken in Scottish waters. Other EU countries also share similar conditions as Norway, suggesting that an independent Scotland would be an essential fishing nation for Norway and the EU. Sixty two percent of Scots insist that Scotland should have policy competence over the United Kingdom's post-Brexit fishing industry [42]. If Scotland's fishing sector is unsatisfied with the TCA and its subsequent fisheries agreements, new negotiations on the

sharing of catch quotas could be triggered. Additionally, Scotland is the main area where British fishermen obtain their catches. Consequently, Scotland has deservedly become the most vocal local government in the United Kingdom regarding fisheries [23]. Coupled with the fact that the matter of Scottish independence is still on the political agenda, the voices of Scotland's fishing sector and fishermen cannot be ignored.

3.2. UK–Norway Fisheries Cooperation

UK Environment Secretary George Eustice and Norwegian Fisheries Minister Odd Emil Ingebrigtsen signed the Fisheries Framework Agreement [43] on 30 September 2020. The parties agreed that the United Kingdom and Norway would negotiate annually on access to waters and quotas, with the rest of the Agreement not being released to the public. As the first post-Brexit agreement signed by the United Kingdom and also the first agreement the United Kingdom signed as an independent coastal state in forty years, it is of historical significance.

Post-Brexit, the United Kingdom is no longer a party to international agreements signed by the EU. Norwegian fishermen cannot enter the UK EEZ until a fisheries agreement is signed between the United Kingdom and Norway. On the other hand, British fishermen are not allowed to enter the offshore area of the Barents Sea to catch cod. However, the Norwegian fishing industry is heavily dependent on the UK EEZ, its exclusion from which would be very costly. In contrast, the dependency of the UK fishing industry on the Norwegian EEZ is very low. Thus, it seems clear that the United Kingdom is in a dominant position regarding its dependence on fishery resources in the North Sea. Nevertheless, the northern archipelago of Svalbard is a powerful weapon in Norwegian fisheries negotiations. It influences fishing quotas in the North Sea, as Svalbard's cod is crucial to British fishermen.

The United Kingdom reached an agreement with Norway on fisheries access and quotas for 2022 on 21 December 2021, marking the start of a new arrangement between the two countries. The agreement covers cooperation regarding surveillance and the exchange of relevant information and data [44]. Both parties permit access to each other's waters and exchange several fish quotas in the North Sea and the Arctic. Furthermore, the agreement highlights both parties' continued commitment to managing fisheries sustainably [45]. Norway allocated to the United Kingdom 6.5 million kg of cod around Svalbard in exchange for a fish quota in the North Sea, which is 1.5 million kg more than that in 2021. This means that the United Kingdom can fish over 7 million kg of cod in the Arctic, estimated to be worth around £16 million [45]. Although Norway's quota for the SFPZ is set unilaterally based on historical catches and, in principle, without a quota exchange, Norway has unilaterally granted the United Kingdom a cod quota in the SFPZ that is larger than the share the United Kingdom has historically received [6]. It is reasonable to assume that this move is a concessionary compromise on the part of Norway in order to encourage the signing of a UK–Norway Bilateral Fisheries Agreement. The UK has stressed that this agreement will not impact its bilateral negotiations with the EU. Those negotiations are ongoing, with a focus on setting TACs for bilateral UK–EU stocks and a range of related technical measures [45].

While expressing dissatisfaction with the agreement's imbalance, Norway also said that the 2022 UK–EU joint quota agreement laid the groundwork and would provide a better starting point for future agreements between the parties. According to the leader of the Norwegian Fishermen's Association, "The solution for whitefish with mutual access can resume a traditional fishing pattern of the Norwegian pelagic fleet in the British zone. It is important to normalize our cooperation with the UK again, and it was, therefore, important to get a joint quota agreement for 2022" [44].

The 2022 joint quota agreement between the United Kingdom and Norway was reached under the 2020 UK–Norway Framework Agreement on Fisheries. The 2020 Framework Agreement on Fisheries only covers issues such as access to the respective area of jurisdiction, the cooperative management of fish stocks, and quota exchanges, excluding issues closely related to fisheries, such as trade. However, it is reasonable to assume that the

parties will reach a more extensive fisheries agreement in the future, including a fisheries trade permit. Notwithstanding Norway's consistent position that there should be no direct link between fisheries quotas and trade [6], the fishing industry is closely linked to trade. The United Kingdom is a huge fish market, and Norwegian seafood exporters' access to this market is essential [23]. Thus, trade policies can impact negotiations on sharing quotas between the parties and other substantial aspects related to fisheries management. There is a strong possibility that Norway will accept the United Kingdom's proposal to reduce quotas for certain species in UK waters and provide quotas for species in the Svalbard area in order to continue enjoying access to the UK EEZ and to maintain full market access to the United Kingdom.

3.3. UK–EU27: The EU–UK Trade and Cooperation Agreement

Following the start of the Brexit process, the United Kingdom and the EU entered into negotiations to reach a new comprehensive agreement on their future relationship. After 1492 days of lengthy negotiations, the EU–UK TCA was signed on 28 April 2021, and it took effect in May of the same year. This TCA "covers a wide range of areas, from fisheries to justice and home affairs, that go far beyond usual Free Trade Agreements" [46], and it positively impacts the strength of the UK–EU relationship. Both parties have given it a positive assessment. It is the beginning of a new chapter in the UK–EU relationship.

Fisheries are a bone of contention in the negotiations between the parties. The EU is an important market for British fishermen [23]. Therefore, fisheries export trade is an important bargaining chip for the EU in its negotiations with the United Kingdom. The EU has also issued alerts to the United Kingdom over shellfish and other seafood exports. Scotland Food and Drink chief executive officer Withers said that British food exporters experienced more than four months of a painful Brexit period [47]. Brexit has increased the costs and risks for UK domestic food exporters doing business with European customers and has reduced shipping speeds, which has hit UK food exporters hard, especially seafood exporters with high timeliness requirements. Furthermore, should the previously balanced trade relationship between the United Kingdom and the EU be disrupted, it would negatively impact not only UK and EU industries but also industries in non-EU countries that have offices in the United Kingdom and the EU and trade goods and services across the English Channel [48].

However, given that the United Kingdom has historically been a great maritime power, fisheries rights make more than economic sense and indicate the symbolic significance of national sovereignty and dignity. Therefore, the United Kingdom has maintained its position of negotiating separately with the EU on the international right of passage of EU vessels. The EU, for its part, wants to maintain the status quo of free access for EU vessels to fish in British waters after the transition period, or it may ban British fisheries from selling goods to the EU market. The vast divergence between the parties led to a stalemate in negotiations. Finally, each party conceded fishing rights to reach an agreement as soon as possible. The EU stated that it respects the United Kingdom's jurisdiction and control over its waters and accepts the United Kingdom's proposed "transition plan for fisheries powers." The United Kingdom will also facilitate EU vessels by granting EU-owned companies incorporated in the United Kingdom the right to own UK-flagged vessels, which are the entry point for a wide range of activities, including maritime transport and fisheries [46]. This step symbolizes a compromise on the part of the United Kingdom to grant EU vessels access to its EEZ. Additionally, the parties agreed to a 5.5-year fisheries adjustment period ending in June 2026. According to the TCA, EU fishermen have the right to continue to fish in UK waters according to the current access criteria during the transition period. However, 25% of the EU quota in UK waters will be gradually transferred to the United Kingdom. The EU has also abandoned its plan to impose trade retaliation on the United Kingdom. At the end of the transition period, the parties will conduct annual negotiations on fisheries issues.

The TCA also specifies the percentage of each shared stock allocated to the EU and the United Kingdom (i.e., the share of the TAC for each party). The parties will conduct annual consultations under the leadership of the EC to determine TACs and quotas for the coming year. The principles of international obligations, the MSY, the best available scientific advice and the protection of fishers' livelihoods are to be considered in this consultation process, since these elements are at the core of the fisheries provisions in the EU CFP and the TCA. The EU Council will provide political guidance to the Commission during the negotiation process and formal approval of the final agreement. The parties also agreed that any disagreement would be resolved through arbitration, and provisions exist for trade measures to be applied by either party if the agreement is breached [49].

In June 2021, the EU and the United Kingdom reached their first annual agreement on jointly managed fish stocks based on the principles and conditions established by the TCA. The agreement set TACs for 70 fish stocks and established provisions for exploiting non-quota stocks in 2021 [50]. The parties agreed on additional fisheries management measures for 2021. Their agreed management measures will replace the interim measures the EU and the United Kingdom each developed separately in order to ensure that fishing activities continue until consultations are concluded and implemented under their respective national or EU laws. As of July 2021, the EU and the United Kingdom agreed on a monthly quota exchange [51]. In December 2021, the EU Council announced that the EU and the United Kingdom reached an agreement on fishing opportunities for 2022, which is the second annual agreement between the United Kingdom and the EU on fisheries within the TCA framework, covering all shared and jointly managed fisheries resources in UK and EU waters [52].

3.4. The Current Situation and Outlook of Tripartite Cooperation amongst the United Kingdom, Europe and Norway

Prior to Brexit, all three parties were bound by the 1980 Agreement, within the scope of which, Norway and the EU have held annual fisheries consultations, and fisheries cooperation has remained stable for more than forty years. Although overfishing occurred for a certain period, flaws do not obscure the fact that the management framework for fisheries cooperation established by the 1980 Agreement ensured the stability of fisheries cooperation and thus the stability of the situation in the North Sea. The principle of relative stability established by the agreement keeps each country's quota shares constant, and all parties benefit from a stable situation.

The 1980 Agreement remains valid for Norway and the EU-27 after the United Kingdom's exit from the EU. However, it cannot bind the United Kingdom after Brexit, and the United Kingdom has become a new coastal state and quota-sharing subject independent of the EU CFP framework, which destabilizes fisheries cooperation under the 1980 Agreement framework. Therefore, Norway, the EU and the United Kingdom must revise the 1980 Agreement or sign a new trilateral fisheries agreement, through negotiations and consultations, that incorporates the United Kingdom as a new quota-sharing subject of the North Sea fisheries.

The current situation is that Norway, the United Kingdom and the EU held two annual negotiations in 2021 on a trilateral management regime for North Sea stocks and consulted on a common fisheries relationship amongst the three parties, including the management of shared fish stocks in the North Sea in 2022. The United Kingdom agreed on the TAC for 2022 for six jointly managed fish stocks in the North Sea with Norway and the EU on 10 December 2021 [45]. The agreed record of the three parties emphasizes that consultations on the trilateral framework agreement, which will be the basis for their future cooperation to ensure the long-term conservation and sustainable use of North Sea fisheries resources, will be intensified. The framework agreement should set out the objectives and scope of cooperation and contain general principles of management, procedural rules for cooperation and provisions for exchanging information between the parties [53]. The three parties hope to complete consultations on the agreement in 2022.

4. Impacts on the Svalbard Fisheries Protection Zone

The Northeast Atlantic, where the warm North Atlantic current meets the cold Arctic current, is rich in fishery resources, including the Barents Sea, the North Sea and the Norwegian Sea. Historically, the Barents Sea was an unregulated open cod fishery with fishing traditions in all European countries. The Barents Sea consists of four main ocean areas: the Norwegian Exclusive Economic Zone (NEZ), the Russian Exclusive Economic Zone (REZ), a high seas area commonly referred to as the Loophole and the SFPZ [54]. Although the setting of quotas in the Svalbard area is based on historical catches and is unrelated to quota trade-offs, changes in the situation of North Sea fisheries can also affect countries' fishing activities in the Svalbard area.

The Svalbard archipelago occupies a vital position in the Arctic region due to its unique geographical location and legal status. In 1920, the signing of the Svalbard Treaty [55] granted Norway sovereignty. Svalbard waters are rich in fishery resources. In 1977, Norway enacted the Svalbard Fisheries Protection Zone Ordinance to establish a 200 nautical mile non-discriminatory fisheries protection zone in Svalbard and to assume responsibility for managing fisheries activities in the SFPZ.

4.1. Management of the Svalbard Fisheries Protection Zone

Under the Svalbard Treaty, Norway has sovereignty over the Svalbard archipelago and, as a coastal state, manages fisheries in the SFPZ. Quotas are an essential tool in fisheries management, and Norway has been allocating quotas concerning the presence and catches of third-country vessels in the SFPZ. Quota setting in the SFPZ is based on historical catches, so, in principle, Norway cannot receive fishing quotas in third countries' EEZs as compensation. Except for Norway and Russia, the quotas for the SFPZ are based on catches in the reference period. The EU also bases its quota allocation in the SFPZ on its historical presence.

The 1980 Agreement between the EU and Norway also encompasses the Barents Sea and thus the SFPZ, and the parties formally engage in quota exchanges within the treaty's framework. Changes in the situation in the sea area covered by the Agreement will affect fisheries in the Svalbard area. In comparison, the Norwegian side argues that Svalbard is under the jurisdiction of Norway's national law and does not need to follow the principle of quota trade-offs [56].

A TAC exists for the entire Barents region, with quotas for the EU and the United Kingdom in the NEZ and SFPZ but not in the REZ. EU vessels with quotas in the SFPZ must harvest their quotas and cannot harvest their quotas in the NEZ. In contrast, EU vessels with quotas in the NEZ can harvest these quotas in the SFPZ. EU countries with quotas in the NEZ and SFPZ can exchange quotas with other EU countries [54].

4.2. EU–Norway Fisheries Divergence

Since establishing the SFPZ, Norway and the EU have had different views and conflicts over the waters around the Svalbard archipelago. In particular, the quota system in fisheries management has been the subject of constant dispute between the two sides, as the EU–Norway snow crab clash has demonstrated. New controversies are expected to arise after Brexit.

4.2.1. The Snow Crab Case

Since establishing the Svalbard fisheries Protected Zone, the Norwegian Ministry of Fisheries has been mandated to manage and supervise fishing activities in the area. For example, access by fishing vessels is authorized and monitored, restrictions on the use of fishing gear are imposed, areas for the protection of juvenile fish are established and maximum allowable catches of species are determined [57]. Controversies surrounding fishing in the Svalbard fisheries Protected Zone are frequent, and the snow crab case is a typical example involving Norway, Latvia and the EU. In January 2017, a Latvian-flagged fishing vessel fishing for snow crabs in the waters around the island was detained by the

Norwegian Coast Guard for "illegal fishing" because it did not hold a permit issued by the Norwegian government. The owner of the Latvian fishing vessel did not accept the administrative penalty and appealed to the District Court, where he lost. He then appealed to the Court of Appeals, where he still received an unfavorable decision. The case was appealed to the Norwegian Supreme Court, which rejected the appeal on the same position and grounds, i.e., Norway did not violate the Svalbard Treaty. The snow crab is a biological resource attached to the island's continental shelf. Norway, of course, enjoys sovereignty over the continental shelf and has the right to issue permits to restrict the fishing activities of fishing vessels from other countries in this area. Therefore, Latvian fishing vessels that have not obtained a permit are fishing illegally and should be punished [58]. Although the EU is not a party to the Svalbard Treaty, because several of its member states are parties to the Svalbard Treaty, the EU has a legal obligation to act to safeguard the legitimate fishing rights of its member states. Consequently, at the end of 2017, the Republic of Latvia called on the EC to act under Article 265 of the Treaty of the Functioning of the European Union (TFEU) [59] to preserve its member states' legal fishing rights on the island. In its response letter, the EC stated that it was not failing in its duty, but it had worked hard to find a solution and would continue to defend and pursue the EU's position in the Svalbard fishery [60].

The controversy in the snow crab case centered on access to the fishing grounds around Svalbard and interpretation of the Svalbard Treaty. The ambiguity of the legal provisions in the Svalbard Treaty and the divergent interests of the parties have led to widely divergent positions and deep-rooted conflicts, and the parties have still not found a common and agreed-upon way to resolve their disputes. There are three positions reflecting different interpretations of the SFPZ and the scope of the application of the Svalbard Treaty: the view that Norway has exclusive rights in these areas that are not subject to the Svalbard Treaty; the position contrary to the view that Norway has no rights outside the territorial sea; and an intermediate model that has been accepted to varying degrees by different contracting parties, which holds that Norway has jurisdiction and sovereign rights outside the territorial sea and that the provisions of the Svalbard Treaty, the non-discriminatory rights in particular, are applicable [61].

There are different legal arguments regarding whether the Svalbard Treaty applies in a zone outside Svalbard's territorial waters. Norway asserts that the Svalbard Treaty applies only to Svalbard's land territory, internal waters and territorial sea. The position of the Norwegian government is that the Treaty is limited to the territorial waters of Svalbard, and the EEZ regime entitles Norway to establish a 200 nautical mile economic zone outside the territorial waters of Svalbard. Therefore, the SFPZ is a maritime area with exclusive rights under the international law of the sea and is not subject to the Svalbard Treaty [62]. Furthermore, the opinions of member states within the EU are divided. Poland, Hungary, the Czech Republic and others argue that Norway has no right to establish an EEZ around the island because Norway acquired its sovereignty over the island by signing the Treaty, and claiming sovereign rights in the surrounding water is contrary to the scope of application of the Treaty, which refers to the "land" and "territorial waters" of the island. Denmark, Spain, the United Kingdom and the Netherlands recognize that Norway may establish a fisheries protection zone around the island; however, they assert that each state party should be guaranteed equal rights under the Treaty in this zone. The dispute over Svalbard is seen primarily as a conflict of laws arising from differences in interpretations of the Treaty. It is foreseeable that the parties' dispute will not soon be resolved through judicial proceedings and that Norway's diplomatic efforts to win international understanding of the management of Svalbard's resources will not lead to a consensus [63].

The differences in the fundamental positions of the two parties have led to disagreements about the fisheries quota system. According to the relevant principles of the UNCLOS and the Svalbard Treaty, Norway unilaterally sets quotas in the Svalbard area based on historical catches. However, the EU disagrees in principle with Norway's view that it has

the right to set and distribute quotas among its members. In the snow crab case, the EU unilaterally sets quotas and continues to issue licenses for snow crab fishing around the Svalbard archipelago [64].

Norway believes that the EU's approach has no legal basis or legal effect [54] and violates the law of the sea and international legislation regulating fisheries [64]. Only coastal states can legally set fishing quotas in areas under their jurisdiction. In the 1970s, before the third United Nations Conference on the Law of the Sea (1973–1982) finally established the 200 nautical mile EEZs, twenty coastal states already claimed exclusive fisheries jurisdiction beyond 12 miles [65]. Those countries that previously established exclusive fishing zones required a prior agreement with flag states or had to apply for a permit for other fishing vessels to sail in their exclusive fisheries zones even before the law of the sea convention. The establishment of the EEZ regime after the UNCLOS vests sovereign rights over the management of marine natural resources in coastal states. With the expansion of coastal states' fisheries management rights, the geographical area of "freedom of fishing" has also been reduced, which requires adjustments to the traditional fishing model. Although Svalbard is entitled to an EEZ under the UNCLOS, Norway has not established such a zone. Instead, Norway has established a 200 nautical mile non-discriminatory fisheries protection zone around the Svalbard archipelago [66]. Norway has strongly emphasized that Svalbard's non-discriminatory fishing regime is to protect marine living resources. The difference between Norway's mainland EEZ and the SFPZ pertains to "exercising administrative power" and is based on "considerations of practicality and effectiveness" [67]. Norway, therefore, has the right to manage fisheries in the Svalbard area by imposing a series of legal provisions on the fisheries protection zone containing TACs, closed areas and reporting obligations. Norway believes that the legal basis for this practice is its competence as a coastal state. Norway sets annual quotas for EU fisheries reserves in the Svalbard archipelago based on historical fishing patterns in the waters around Svalbard. Norway claims that it is not bound by any internal reallocation of such quotas by the EU among its member states.

However, the EU views Norway's approach as violating the "non-discrimination clause" in the Svalbard Treaty [68]. In accordance with the EU's long-standing position on the status of the Svalbard archipelago under the Treaty of Paris of 1920; the applicability of the relevant provisions of the Treaty to fishing activities in the fisheries protection areas around the Svalbard archipelago; and the conditions and restrictions on Norway's right to take measures to protect fisheries resources in these waters in accordance with the Treaty [69], member states that are parties to the Treaty are entitled to equal access to the fisheries resources of the Svalbard archipelago. By means of a note verbale, the EU opposes any discriminatory measures by Norway.

4.2.2. New Post-Brexit Controversy

A new controversy over quotas has arisen in the wake of Brexit. The announcement of Brexit and the United Kingdom's withdrawal from the EU CFP after the transition period means that the United Kingdom will take away its fishing quota around Svalbard. For its part, Norway claims that, since establishing the SFPZ, it has been allocating fishing quotas to countries that historically fished in the Svalbard area; therefore, they may continue their fishing activities. The Norwegian Ministry of Trade, Industry and Fisheries announced that the sharing of quotas was based on fisheries in the ten years prior to the creation of the zone. Due to Brexit, the United Kingdom's historic fisheries may no longer constitute a foundation for the EU's quotas. Therefore, its historic fisheries should be deducted when the EU quota is calculated [56].

There is also positional divergence between the United Kingdom and Norway on the issue of quotas. Under the 1980 Agreement, the value of Norwegian landings in British waters was eight times that of British landings in Norwegian waters. The British approach to the negotiations therefore aims to take the new fisheries arrangement with Norway beyond the 1980 Agreement such that quotas and access Norwegian fishing vessels enjoyed

in British waters should result in a more proportionate return to the United Kingdom in Norwegian waters, in the hope of receiving quota compensation in the Svalbard area. On the other hand, Norway believes that bilateral arrangements should be based on the United Kingdom's traditional level of access as an EU member state. The divergence has stalled negotiations toward a 2021 agreement on bilateral access and quota exchange arrangements between the two parties. The Norwegian side said it was surprised by the United Kingdom's lack of concessions on regional access [70], but out of a desire to reach a win–win fisheries agreement, the Norwegian authorities adopted a special arrangement to give British pelagic fishing vessels access to the waters around Svalbard [71].

Norway and the EU have divergent views on the cod quota in the Svalbard area [54]. At its October 2020 meeting, the Russian–Norwegian Fisheries Committee set aside 31,751,466 kg of cod for third countries to fish in the SFPZ. Furthermore, in the EU Council Regulation 2021/92 of 28 January 2021 [72], the EU unilaterally set a quota for cod fishing in its member states in the SFPZ that far exceeded the quota that Norway set for the EU. Additionally, previously, the EU allocated fishing opportunities in the same area to the United Kingdom without consulting Norway as a coastal state [73]. The cod quota in the SFPZ can be seen as an "incidental payment" in the larger fisheries game involving Norway, the United Kingdom and the EU, even though the SFPZ quota is autonomous and, in principle, not subject to quota exchange [54].

The EU views Norway's practices as in violation of the "non-discrimination clause" in the Svalbard Treaty, which gives Norway the right to govern fisheries activities as a coastal state. In a note verbale dated 26 February 2021, the EU delegation alleged that Norway's allocation of fishing opportunities in the SFPZ was discriminatory and favored Norwegian and Russian fishing areas [73]. The EU wants Svalbard resources to be equally distributed among the countries that signed the Svalbard Treaty.

Norway rebutted again, saying, "That is not the case"; for shared stocks that straddle the Norwegian and Russian maritime areas, Norway and the Russian Federation jointly determine quotas for the totality of the stocks' distribution area, granting each other's vessels reciprocal zonal access [73]. In 2021, when the TAC was established, there was a "surplus" of 9.674 million kg in the 2021 third-country cod quota. In a letter from the Norwegian Directorate of Fisheries to the Norwegian fishing industry [54], the Directorate asked for advice on how this would be divided between the different sectors of the industry. However, the directorate stated that half of this "surplus" belonged to Russia. This implies that, even if there is a surplus of quotas, Norway cannot unilaterally decide to allocate them to the EU.

After Brexit, Norway reallocated cod quotas in the SFPZ under Norwegian regulations, but Brexit rationale alone cannot explain these changes. It seems that Norway has taken unilateral steps to reduce the EU fishery in the SFPZ independent of the United Kingdom leaving the EU [54].

The differences in standpoint and underlying principles between Norway and the EU concerning fishing activities in the SFPZ are the source of their disagreement. Norway has insisted on a quota exchange, hoping for compensation for its quotas in the SFPZ with stocks in other marine areas. Moreover, the EU has sought an arrangement for the Svalbard area based on equal fishing rights rather than a quota-exchange-based solution for the entire Norwegian continental shelf [60]. This is because the EU realizes that reaching a practical arrangement for Svalbard without abandoning its position will be very difficult and time consuming [60]. Quota setting for exclusive stocks is based on historical fishing patterns and should be balanced among countries based on fixed ratios that have been established. However, it may also be affected by variations in the size of the stocks. For example, the recent expansive development of the cod stock in the Barents Sea has led to an increase in the quota proposed to the EU. In contrast, stocks offered as compensation from the EU to Norway have not developed similarly. Consequently, Norway has retained parts of the quota offered to the EU [4].

4.3. Conflict Expansion: The Arctic Council

The EU has always been cautious regarding Svalbard, as its fishery has far more implications than it has merely in itself. In the years before 1986 (when Spain joined the EU), Spain caught 90,718,474–136,077,711 kg of cod off Svalbard, despite Norway's request to reduce catches. Following the accession of Spain and Portugal to the EU, Norway has had informal diplomatic discussions with the EC. In July 1986, Norway stopped cod fishing around Svalbard because the TAC Norway set had been reached. Divergences arose between the two parties. Although the EU disapproved of Norway's actions, it accepted Norwegian jurisdiction and reached an informal understanding with Norway in August 1986. In the snow crab case, the EC also stated in its response letter that the issues at stake around Svalbard go beyond fisheries' interests, and the spillover risks are an essential element that must be taken into account at every step of the way [60].

It can be seen that a slight move in the fisheries issue may have a butterfly effect, and in the interest of preventing spillover of the conflict, the EU's attitude is sensible and moderate. Despite this, Norway has taken a hard line, even showing an intention to link the fishing rights dispute to the EU's position in the Arctic Council, which will inevitably be drawn into the conflict, especially after Norway takes over rotating chairmanship of the Arctic Council in 2023.

The Norwegian Ministry of Foreign Affairs has repeatedly stated that the EU has no right to establish quotas in maritime areas around Svalbard under international law. As an observer to the Arctic Council, the EU must respect Norway's sovereign rights and jurisdiction in the Arctic. The criteria for admitting observers to the Arctic Council include recognition of the Arctic states' sovereignty, sovereign rights and jurisdiction in the Arctic. Furthermore, the criteria include recognizing that an extensive legal framework applies to the Arctic Ocean, including the UNCLOS. This framework provides a solid foundation for responsible management of the Arctic Ocean. The EU's unilateral establishment of fishing quotas in Norwegian Arctic waters is not in line with these basic principles of multilateral engagement and cooperation in the Arctic [73]. Norway's statement can be interpreted as an indirect threat; failure to comply with the game's rules will result in disallowance from joining the Arctic Club.

This is a significant and arguably uncharacteristic escalation. The EU has yet to receive full observer status due to opposition from Russia [74] (and previously from Canada [75]) but has still been allowed to attend meetings with other observers. Canada has withdrawn its reservation to EU observer status at the Arctic Council, and the Arctic Council ministerial meeting did not address the issue of observers but rather deferred decisions on pending observer issues [76]. Norway's signaling of the fragility of this arrangement could produce a culture within the organization in which disagreements with permanent members come at the risk of expulsion. Expulsion would, however, have to be imposed with the consensus of other Council members who could take exception to bilateral issues interfering with multilateral governance within the Council. With the EU's unique status as a quasi-observer, its fate could come down to Norway's unilateral decision once it begins its chairmanship, should it choose to interpret Article 38 of the Arctic Council Rules of Procedure [77] as giving the chair such authority. Such an act could discourage other states and organizations from seeking observer status and participation within the forum [78].

The conflict between the EU and Norway regards overfishing in Svalbard, but the primary remit of the Arctic Council is environmental and climate cooperation. The proliferation of this conflict is not only pointless regarding a solution but could even have a very negative effect. Norway's dissatisfaction with the EU and its member states over the Svalbard area fisheries has affected Norway's attitude and cooperation with these parties within the Arctic Council. Based on the fact that Norway and these countries also have bilateral or multilateral relations outside the framework of the Council, it also exacerbates tension within the Arctic region itself outside the Arctic Council.

Russia has held the rotating chairmanship of the Arctic Council since 2021, and its tenure ends in 2023. As the premier forum for Arctic governance, the Arctic Council is often

insulated from geopolitical tensions. However, under the influence of the Russia–Ukraine conflict, Western countries have announced sanctions against Russia [79]. The Russian–Ukrainian conflict has brought the Arctic Council's operational mechanisms to a halt, and the Council is challenged by internal divisions, unprecedented resistance to international cooperation in the Arctic and stagnation of the work carried out under its framework. Currently, the Russian–Ukrainian conflict is still escalating in a protracted manner. In June 2022, seven member states announced limited resumption of the Arctic Council regarding projects that do not involve the participation of the Russian Federation [80]. Against the backdrop of a protracted Russian–Ukrainian conflict, the Arctic Council can no longer function in a consensus-based format, as the work of the Arctic Council and its subsidiary bodies has not effectively returned to its previous conditions.

Against the backdrop of the ongoing Russia–Ukraine conflict and climate change, Arctic cooperation is in a difficult situation, and Arctic fisheries are being negatively affected by both political and environmental factors, casting a shadow of uncertainty over the future of the Arctic Council. Therefore, it is necessary to address the fisheries issue against the backdrop of the potential for multiple conflicts and increased uncertainty, at least by enhancing dialogue and discussing interim solutions.

5. Conclusions

The Northeast Atlantic is rich in fishery resources, including the Barents Sea, the North Sea and the Norwegian Sea. The North Sea fishery, which is rich in fish production and variety, forms the center of the North Atlantic fishery and is one of the four principal fishing grounds in the world. Norway and the EU have been cooperating steadily on fisheries management in the North Sea for more than forty years since the 1980 Agreement. Moreover, the signing of the EEA Agreement has provided a free circulation market for countries to trade in fisheries.

The United Kingdom's exit from the EU has made it a new independent coastal state and quota-sharing subject in the North Sea fisheries, creating a challenge to the stable situation in the North Sea. The arrangement of fisheries cooperation will affect not only countries' socio-economic structure and international relations but even the situation in other sea areas, one of which is the SFPZ. However, behind the conflict over the fishing quota in Svalbard is a deeper divide and a more severe risk of spillover.

Norway, the EU and the United Kingdom have a long tradition of cooperation in fisheries management and trade in fish and fish products. Each party has its advantages in their tripartite negotiations. The United Kingdom's leverage is the fisheries resources in its EEZ. Norway's is the fisheries resources in the SFPZ. Last, although in a disadvantageous position regarding fisheries resources, the EU has a vast market, giving it a voice in the negotiations. Win–win cooperation is a common expectation among the three parties, and there is a high probability of achieving that outcome.

Assuming that the three parties fail to reach a consensus on the issues of maritime zone access and fish quotas as soon as possible, such failure to do so will not only adversely affect various areas in each country, such as fisheries and trade, but will also threaten the operation of the Arctic Council and the stability of the Arctic region. Therefore, concerning fisheries, the three parties should maintain close dialogue, work to resolve disputes and establish a new legal framework for fisheries cooperation, covering trade as soon as possible. The 1980 Agreement should be revised, or a new trilateral agreement should be established to achieve win–win cooperation in fisheries management and to ensure the socio-economic sustainability of fisheries. In conclusion, Brexit has had a substantial impact on the previous management regimes in the North Sea and Svalbard Sea area and has added instability to the situation of Arctic governance, which still needs further research and continuous tracking.

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Scientific Research and Its Influence in Decision-Making of Tuna Regional Fisheries Management Organizations: Case Studies in the Atlantic Ocean and Indian Ocean

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Abstract: Scientific research has played an important role in the conservation and management of high seas fisheries resources since the adoption and entry into the force of the 1982 United Nations Convention on the Law of the Sea (UNCLOS). In addition, regional fisheries management organizations (RFMOs) have become the most important platform in addressing fisheries-related issues under the contemporary international fisheries legal regime, which also includes the responsibility to ensure that their decisions have to properly incorporate recommendations of scientific research into their decisions. This paper aims to analyze, from a legal aspect, how scientific research plays its role in the formation and adoption of conservation and management measures (CMMs) in RFMOs and finds that scientific research has become an essential and integral part of both International Commission on the Conservation of Atlantic Tunas (ICCAT) and the Indian Ocean Tuna Commission (IOTC). Although, on some occasions, these recommendations will not be totally accepted and adopted by the Commission due to social, economic, and political considerations, the results from scientific research have become the basis for issues related to conservation and management measures discussed in RFMOs and will be more influential if the Scientific Committee provides a more concrete recommendation to the Commission.

Keywords: scientific research; international fisheries legal regime; high seas fisheries management; conservation and management measures (CMMs); regional fisheries management organizations (RFMOs); Scientific Committees; International Commission on the Conservation of Atlantic Tunas (ICCAT); Indian Ocean Tuna Commission (IOTC)

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1. Introduction

The conservation and management of high seas fisheries has been highly concerned since fishing technologies have been significantly improved, which resulted in the tremendous increase in terms of fishing capacity, fishing effort and spatial extent worldwide, and the emergence of distant water fishing nations (DWFNs) [1]. Increasing the fishing capacity of those DWFNs has resulted in a tremendous decrease or even depletion of those fisheries resources [2]. It has been recently indicated by many international organizations, including the United Nations Food and Agriculture Organizations (FAO), that almost 90 percent of global marine fish stocks are now fully exploited or overfished [3,4]. Therefore, how to conserve and manage marine fisheries resources, particularly those on the high seas, has become an important issue in the international community [5].

To this end, scientific research has been expected to be an important element to facilitate better the conservation and management of high seas fisheries resources since the last quarter of the 20th century, particularly after the adoption and entry into the force of the 1982 United Nations on the Law of the Sea (UNCLOS) [6]. Scientific research provides

better information of the current status of fisheries resources in the oceans and thus assists the States and regional fisheries management organizations (RFMOs) to determine more accurate effective conservation and management measures (CMMs) to meet the goals of sustainable development, such as total allowable catch (TAC), quotas of a specific fish species allocated to the States, and restrictions of fishing seasons and areas, as well as the limitations of fishing gear and the number of fishing vessels [7]. All of these are the major agendas discussed in each of the international fisheries forums today.

Meanwhile, RFMOs have become the primary cooperative mechanism addressing the conservation and management of fisheries resources and fishing activities on the high seas, particularly tuna RFMOs [8]. As of today, many RFMOs have established their own Scientific Committees or relevant subsidiary bodies to conduct in-house scientific research for fisheries resources under their authority. Details of the scientific research and stock assessments of a certain species, such as the status quo of a fish species, TAC, and the probability of the biomass to be recovered in a specific year, will be provided by the Scientific Committee and relevant Working Groups to the RFMO [9]. The organization will mostly make decisions for its CMMs according to the recommendations made by the Scientific Committee. Despite this, however, on some occasions, there will be exceptions, meaning that the recommendations from the Scientific Committee will not be totally accepted by the organization [10].

This paper aims to analyze scientific research in international fisheries management through the analysis of current practices in RFMOs, with special reference to tuna RFMOs in the Atlantic Ocean and Indian Ocean. This paper firstly discusses scientific research-stipulated international fisheries legal instruments. Secondly, this paper analyzes the current practice of scientific research in tuna RFMOs in the Atlantic Ocean and the Indian Ocean, namely the International Commission on the Conservation of Atlantic Tunas (ICCAT) and the Indian Ocean Tuna Commission (IOTC), of which the authors have some close observations for the practice of scientific research in these two organizations by attending their relevant meetings. Further, this paper analyzes how scientific research is conducted in these two RFMOs and provides examples on how the Scientific Committee operates to address issues related to scientific research, particularly the determination of TAC. Lastly, this paper provides discussions on the differences of both RFMOs and conclusions based on the research findings.

2. Regulations and Importance of Scientific Research under International Fisheries Laws

International efforts to maintain and rebuild marine fisheries resources began in 1970s, and later, these actions were further incorporated into UNCLOS [11]. As mentioned earlier, UNCLOS was the first international convention to mention the concept of scientific research in the conservation and management of marine fisheries. For example, in Article 61 "Conservation of the living resources", paragraph 2 states that "[t]he coastal State, taking into account the best scientific evidence available to it, shall ensure through proper conservation and management measures that the maintenance of the living resources in the exclusive economic zone is not endangered by over-exploitation". In this paragraph, UNCLOS requires that coastal States must consider and incorporate scientific evidence when they endeavor to maintain fisheries resources not endangered or overfished in their EEZs [12]. Similar regulations also exist in Part VII, Section 2 of UNCLOS for the conservation and management of the living resources of the high seas. In Article 119 "Conservation of the living resources of the high seas", paragraph 1 stipulates that, in deciding the TAC and establishing CMMs for marine living resources in the high seas, States shall "take measures which are designed, on the best scientific evidence available to the States concerned". Paragraph 2 of the same article also stipulates that "[a]vailable scientific information, catch and fishing effort statistics, and other data . . . shall be contributed and exchanged on a regular basis . . . " Thus, in many aspects, UNCLOS "obligates states to

conserve wide-ranging and valuable species" [13], particularly the straddling and highly migratory species.

The adoption of the United Nations Fish Stocks agreement (UNFSA) achieves a major step forward in the development of a comprehensive legal regime for the long-term conservation and sustainable use of straddling and highly migratory fish stocks, which were contently mentioned but not clearly practically stipulated in the provisions of UNCLOS. UNFSA significantly amends and improves the relevant regulations related to those fish stocks in UNCLOS and, further, provides detailed measures related to scientific research in its provisions. For examples, Article 5, "General Principles", requires States to "ensure that such measures are based on the best scientific evidence available" and "apply the precautionary approach in accordance with Article 6". In addition, the article stipulates that States shall "promote and conduct scientific research and develop appropriate technologies in support of fishery conservation and management". Furthermore, Article 6, "Application of the precautionary approach", stipulates that "the absence of adequate scientific information shall not be used as a reason for postponing or failing to take conservation and management measures". In addition, it also states that "States shall take measures to ensure that, when reference points are approached, they will not be exceeded". Therefore, UNFSA not only establishes a more comprehensive legal regime for the conservation and management of straddling and highly migratory species but also requires those measures to be adopted "based on the best scientific evidence available and for States to be more cautious when information is uncertain, unreliable or inadequate [14]".

In addition to these two international, legally binding documents, other international fisheries instruments also provide regulations related to scientific research in their provisions, including "soft laws" that are non-legally binding to States. Hard laws, usually entitled "Convention" or "Agreement", mean that they are established and regulated by legally binding instruments. States are compelled to comply with the regulations stipulated in those legally binding instruments and are also subjected to enforcement and punishment (if any exists in their articles) if they do not fulfill their legal obligations. On the other hand, the contents in soft laws, usually entitled "Declaration", "Code of Conduct", or "International Plan of Action", are not compulsory, and there are usually no enforcement or punishment provisions. Thus, States are, in fact, in a voluntary spirit and address the subjects called upon in the instrument based on their goodwill [15]. For examples, Article 6.4 of the 1995 FAO Code of Conduct for Responsible Fisheries (CCRF) states that "conservation and management decisions for fisheries should be based on the best scientific evidence available", and States should "assign priority to undertake research and data collection in order to improve scientific and technical knowledge". Meanwhile, the regulations in Article 6.5 are very similar to those in UNFSA, which establishes that States and RFMOs "should apply a precautionary approach widely . . . , taking account of the best scientific evidence available". More importantly, "the absence of adequate scientific information should not be used as a reason for postponing or failing to take measures [16]". Further, the regulations related to scientific research also exist in the International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (IPOA-IUU), adopted by FAO in 2001. In the section of "Internationally Agreed Market-Related Measures", it states that "States should ensure that measures on international trade in fish and fishery products are transparent, based on scientific evidence . . . " Additionally, in the section of Research, it provides that "States should encourage scientific research on methods of identifying fish species from samples of processed products [17]". Therefore, these soft laws not only apply scientific research to the conservation and management of fish stocks but also extend to processing and trading measures or postharvest stages.

3. Regional Fisheries Management Organizations in High Seas Fisheries Management

Since the adoption of UNFSA, RFMOs have become the major platform for the States to address the cooperation and negotiation of high seas fisheries management. As mentioned above, there are already plenty of RFMOs established as of today, but different

terminologies have been used to describe these kinds of organizations in international fisheries communities [18]. For example, FAO, the leading and the only global organization responsible for fisheries-related issues, uses the term "Regional Fishery Bodies" (RFBs) for these fisheries organizations. In addition, the types and mandates of these RFBs differ tremendously because of their constitutional agreements. Not all of them have the authority to regulate activities related to fishing operations in their area of competence. Those RFBs that have mandates to regulate fisheries operations and resources in their area of competence are named "RFMOs". For the purpose of this manuscript, the term "RFMOs" is selected to describe those regional organizations. In addition, using the term "RFMO" is also consistent with that used in modern international fisheries instruments, such as UNFSA and IPOA-IUU.

The establishment of RFMOs is primarily because of the common interests among States concerns. Through RFMOs, States can cooperate with each other to overcome conflicts regarding the utilization of marine fisheries resources and then are able to share the revenues from fisheries activities, as well as establish principles, regulations, and procedures for further cooperation among them [3]. Despite this, however, the performance and effectiveness of each RFMO heavily depend upon the political will of its members, particularly relevant regulations in its constitutional agreement, and funding provided by its member States. Based on FAO, as shown in Figure 1, there are already over 50 RFMOs around the global oceans [19].

Figure 1. Illustrative Map of the Regional Fisheries Bodies. Reproduced from [19], with permission from Food and Agriculture Organization of the United Nations, 2022.

RFMOs can be generally categorized by different criteria into different types. The first criterion is their connections with FAO. RFMOs that are established within the framework of the FAO Constitution or a specific provision in their constitutive agreements clearly states the linkage with either Article VI or Article XIV of the FAO Constitution are "FAO statutory bodies", such as the Indian Ocean Tuna Commission (IOTC) and the General Fisheries Commission for the Mediterranean (GFCM). Other RFMOs outside the FAO framework are "autonomous RFMOs", which usually obtain greater self-ruling power than those under the FAO framework (e.g., Inter-American Tropic Tuna Commission, IATTC). Secondly, RFMOs can be categorized by the target species under their authority. For examples, ICCAT is responsible for highly migratory stocks (HMS), such as tunas. Thirdly, the classification of RFMOs is regarding their missions or mandates. For examples, IATTC is with the

mandate to conserve and manage fisheries resources within its area of competence, but the International Scientific Committee for Tuna and Tuna-Like Species in the North Pacific Ocean (ISC) is without such a mandate, which is only for purely scientific research and advice purposes for other RFMOs [20].

4. International Commission for the Conservation of Atlantic Tunas and Scientific Research

ICCAT was established by the International Convention for the Conservation of Atlantic Tunas (ICCAT Convention) [21], which was adopted at a Conference of Plenipotentiaries convened by the FAO Director General in Rio de Janeiro, Brazil in 1966. The ICCAT Convention entered into the force on 1 April 1969. Although FAO initiated the negotiation of the ICCAT Convention, ICCAT did not become a FAO statutory body, as mentioned above. In other words, the ICCAT Convention eventually has no specific provision stating a link with any provision of the FAO Constitution. However, the Director General of FAO continues to exercise the depositary function for the ICCAT Convention, meaning that there are still connections between ICCAT and FAO and greater than other autonomous RFMOs [22]. Currently, the ICCAT has 52 Contracting Parties and 5 Cooperating Non-Contracting Parties, Entities, or Fishing Entities [23]. The Convention Area of ICCAT, as stated in Article 2 of the ICCAT Convention, "shall be all waters of the Atlantic Ocean, including the adjacent Seas". In other words, seas adjacent to the Atlantic Ocean, such as the Mediterranean Sea, the Black Sea, and the Caribbean Sea, also belong to the ICCAT Convention Area, as shown in Figure 2.

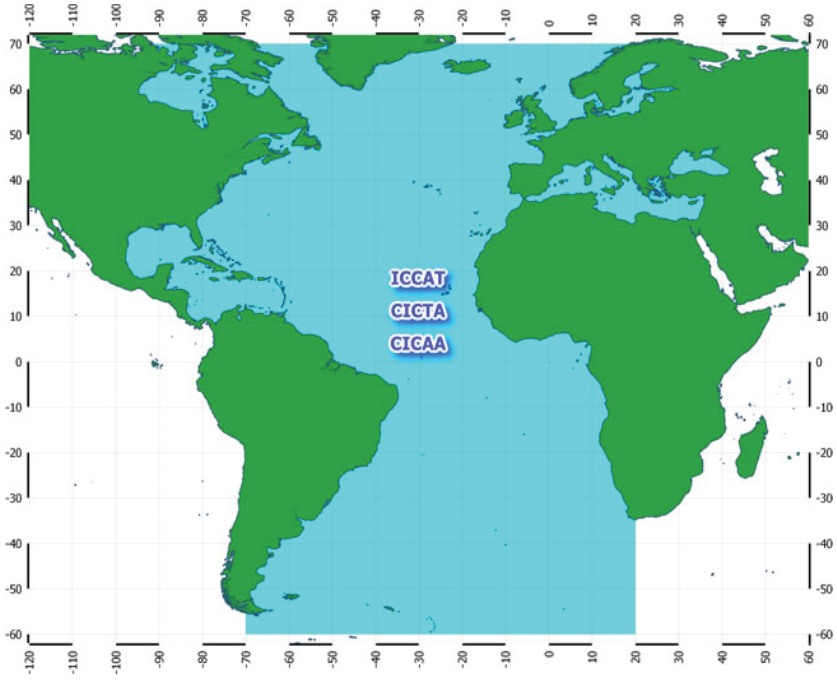

Figure 2. Convention Area of the ICCAT. Reproduced from [24], with permission from International Commission for the Conservation of Atlantic Tunas, 2022.

As regards the scientific research, several provisions in the ICCAT Convention provide relevant regulations to this end. For examples, Article IV, paragraph 1 states that "[t]he Commission, in carrying out these responsibilities shall, insofar as feasible, utilise the technical and scientific services of, and information from, official agencies of the Contracting

Parties". Article VI, paragraph 1 also stipulates that each Panel "shall be responsible . . . for collecting scientific and other information relating thereto". Furthermore, Article VIII requires that the "Commission may, on the basis of scientific evidence, make recommendations designed to maintain the populations of tuna and tuna-like fishes". All of these contents indicate that scientific research has been an essential part for the operation of ICCAT regarding the conservation and management of ICCAT species.

To fulfill those requirements, a Standing Committee on Research and Statistics (SCRS) has been established in charge of matters relevant to scientific research, data collections, and statistics in ICCAT, the purpose of which is to "develop and recommend to the Commission such policies and procedures in the collection, compilation, analysis and dissemination of fishery statistics as may be necessary to ensure that the Commission has available at all times complete, current and equivalent statistics on fishery activities in the Convention area" [25]. However, it is worth noting that the establishment of SCRS was not stipulated in any provisions of the ICCAT Convention. Rather, details of the establishment of SCRS were in the ICCAT Rules of Procedure, Rule 13 of which stipulates that "there shall be a Standing Committee on Research and Statistics on which each member country of the Commission may be represented" [26]. In addition to SCRS, some Working Groups (WGs) related to scientific research were also established and convene every year if necessary. In 2018, the WG meetings related to scientific research included:

- λ Blue marlin data preparatory and stock assessment meetings;
- λ MSE Bluefin Tuna (BFT) intersessional meeting;
- λ MSE Northern swordfish intersessional meeting;
- λ Small Tuna Species Group intersessional meeting;
- λ Meeting of the ICCAT Working Group on Stock Assessment Methods;
- λ Sharks Species Group intersessional meeting [27].

As regards how scientific research procedures are conducted in the ICCAT, following this study, the Bigeye Tuna (BET) stock assessment in 2018 is an example to illustrate. BET is a strictly managed fisheries resource in the ICCAT, including the TAC and national quota of each fleet. Generally, the Commission of the ICCAT decides the TAC and subsequent national quota of BET for a term of three (3) years. In 2018, it was time to decide the TAC and national quota of BET for the following 2019–2021 based on the stock assessment that examines the current status of BET in the Atlantic Ocean.

At the beginning, the Secretariat of ICCAT initialed a process to conduct an assessment that included a data preparatory meeting to collect biology information and fisheries indicators from Contracting Parties and Cooperating non-Contracting Parties, Entities, or Fishing Entities (hereinafter, CPCs) during the meeting. Following, the BET data preparatory meeting serves as a first step to review the reported catch data, indices of abundance, and other relevant biological and fisheries information aiming for BET stock assessment. The participants of the working group that were from different CPCs reviewed and discussed all the information provided and, while appropriate, revised or provided additional comments [28].

Next, the Secretariat presented up-to-date fisheries statistics available to the meeting participants, including Task I (nominal catches) data and Task II (catch and effort, size frequencies, and catch-at-size) of BET. It was to review fisheries indicators, particularly catch per unit effort (CPUE) for BET and, primarily, catch data from CPCs such as those provided by Brazil and Spain Governments, as well as available indices of relative abundances by fleet and estimations of combined indices. Lastly, possible models for stock assessment were proposed and discussed regarding the feasibility of the use in modeling the population dynamics. At this time, the scientists in the meeting agreed to conduct assessments based on surplus production models, stock synthesis, and a virtual population analysis. However, the fleet structure, model setup, and specifications mostly remained the same as in the last assessment in 2015 [28].

After the preparatory meeting, the Secretariat then convened the stock assessment meeting one to three months later to complete the task of BET stock assessment, and the

results of this evaluation will be considered and presented for the subsequent plenary meetings convened later this year. Based on all available data adopted during the data preparatory meeting, such as the aforementioned biology information, catch, efforts, and size estimates, the stock assessment models and their specifications were developed after a comprehensive discussion; in this case, that includes Stock Synthesis III (SS3), Just Another Bayesian Biomass Assessment (JABBA, a new and open-source modeling software), and MPB. After several sensitivity runs of adjustments, the current status of the BET stock was concluded (shown in Figure 3 and Table 1) for the reference of SCRS and other meetings [29].

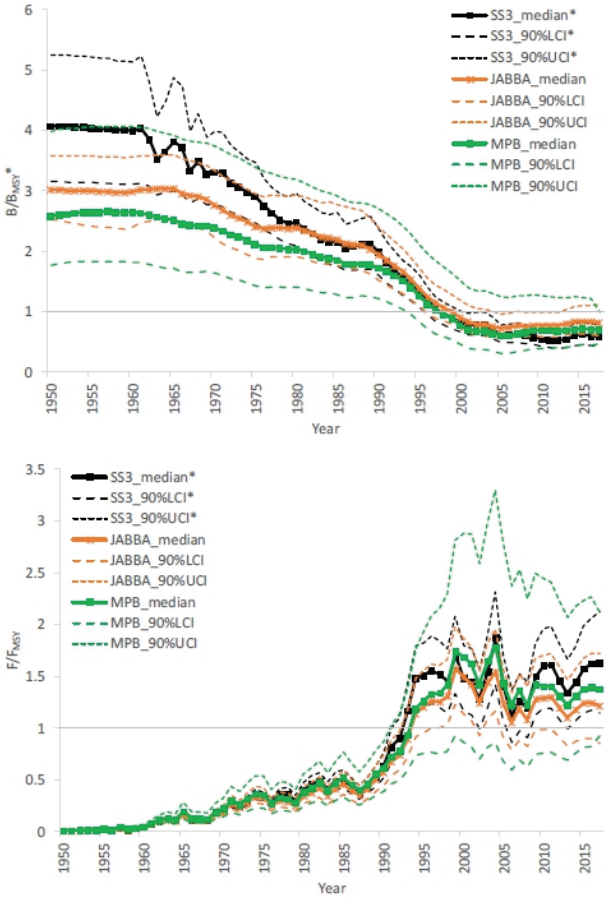

Figure 3. Comparison of the results from different models between 1950 and 2017 for Atlantic BET with 90% confidence intervals. * indicates the results from SS3 are distinguished from the other two models and decided as the stock assessment recommendations to the Commission. Reproduced from [29], with permission from International Commission for the Conservation of Atlantic Tunas, 2022.

Table 1. Statistics summary of the stock status, benchmarks, and key parameters from the three stock assessment models for Atlantic BET. Reproduced from [29], with permission from International Commission for the Conservation of Atlantic Tunas, 2022.

Assessment Method Estimates	Median	SS3 90%LCI	90%UCI	Median	JABBA 90%LCI	90%UCI	Median	Mpb 90%LCI	90%UCI
F_{2017}/F_{MSY}	1.629	1.143	2.123	1.210	0.851	1.723	1.373	0.926	2.121
B_{2017}/B_{MSY} *	0.590	0.426	0.797	0.824	0.601	1.115	0.707	0.468	0.989
B_{MSY} *	425,601	427,979	444,593	408,041	290,355	665,500	411,499	278,845	628,778
F_{MSY}	0.193	0.150	0.238	0.191	0.105	0.283	0.194	0.110	0.317
MSY	76,232	72,664	79,700	77,636	66,601	86,575	80,359	69,340	88,348
K **	1,404,845	1,010,578	1,831,922	1,342,195	941,998	2,183,037	1,123,463	1,118,011	757,601
r	-	-	-	0.133	0.072	0.212	0.195	0.110	0.317

* SBB (SS3) or exploitable biomass (production models); ** Virgin SSB (SS3) or carrying capacity (production models).

5. Indian Ocean Tuna Commission and Scientific Research

The IOTC was established by the Agreement for the Establishment of the Indian Ocean Tuna Commission (IOTC Agreement), which was adopted by the FAO Council at its 105th Session in Rome on 25 November 1993 and later entered into the force on 27 March 1996 [30]. Since IOTC is established under Article XIV of the FAO constitution, it is a "FAO statutory body" within the FAO framework. The establishment of the IOTC was to replace the former Indian Ocean Fishery Commission (IOFC), which entered into effect in the 1970s but was not able to effectively manage the increasing fishing activities in the Indian Ocean due to a lack of necessary mandates [31]. Currently the IOTC has 30 member States and two Cooperating non-Contracting Parties (CNCPs) [32]. The area of competence of the IOTC, as stated in Article 2 of the IOTC Agreement, is the Indian Ocean (FAO statistical areas 51 and 57) and adjacent seas, as shown in Figure 4 [33].

As regards the legal regulations related to scientific research, Article V of the IOTC Agreement clearly states that the Commission shall "encourage, recommend, and coordinate research and development activities in respect of the stocks and fisheries" covered by the IOTC Agreement. To this end, the Commission, the highest decision-making body in the IOTC, established the Scientific Committee as an advisory body to the Commission. The Scientific Committee includes scientists from IOTC member States, as well as experts from non-Member States, intergovernmental organizations (IGOs), and nongovernmental organizations (NGOs). In order to facilitate the work of the Scientific Committee, several Working Parties (WPs) have been established to this end. The objective of WPs is to analyze technical issues related to the management goals of the Commission. For example, WPs related to different species (i.e., neritic tunas) aim to analyze the status of the stock and provide options to the Scientific Committee for management recommendations to the Commission. Currently, the active WPs include:

- λ WP on Billfish (WPB);
- λ WP on Data Collection and Statistics (WPDCS);
- λ WP on Methods (WPM);
- λ WP on Neritic Tunas (WPNT);
- λ WP on Temperate Tunas (WPTmT);
- λ WP on Tropical Tunas (WPTT);
- λ WP on Ecosystems and Bycatch (WPEB).

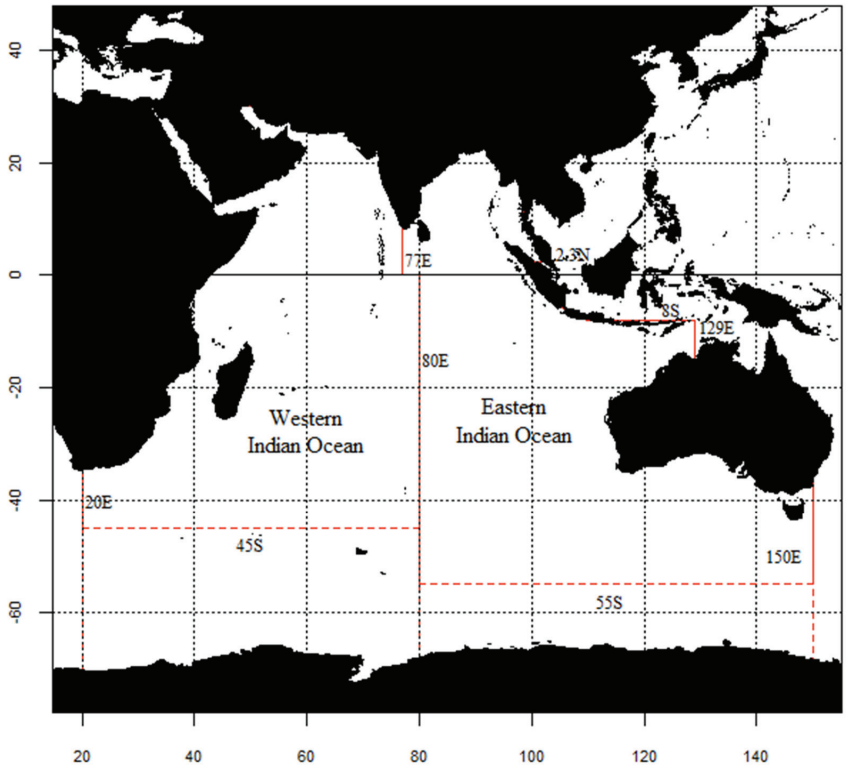

Figure 4. IOTC area of competence. Source: IOTC website. Reproduced from [33], with permission from Indian Ocean Tuna Commission, 2022.

The scientific research procedures in the IOTC are very similar to those of the ICCAT. Again, when taking BET as an example, in 2016, the Commission of the IOTC decided to conduct a stock assessment for BET in the Indian Ocean and requested the Working Party for Tropic Tunas (WPTT) in charge of this assessment. Firstly, the Secretariat developed a series of maps, figures, and tables that highlight the historical and emerging trends in the fisheries data held by the Secretariat and summaries any important reviews to the series of historical catches for BET: a range of fishery indicators (catch and effort trends) for fisheries catching BET in the IOTC area of competence [34]. This document was submitted to the WPTT for discussions and considerations of the member States. In fact, the fisheries information considered in the BET stock assessment in the IOTC was almost the same was that conducted by the ICCAT, such as catch data, fisheries indicators, length frequency data, tagging release/recovery locations, and relevant biological parameters. Further, potential population dynamics models were discussed, including structure and initial conditions, recruitments, movements, fisheries dynamics, and a statistical framework. Following, the models for stock assessment and factors were decided, as well as estimation of the parameters for the final model options [35].

Among these models, the results based on the SS3 model were selected as the management advice for BET, because a more comprehensive range of model options was investigated, and a range of diagnostics indicated that the model represented a reasonable fit to the data from fisheries and their biology. Finally, the assessment was concluded by producing projections from assessment models (shown in Figure 5 and Table 2) to indicate scientifically an optimal, sustainable level of exploitation for the BET resource for the references of the Scientific Committee, as well as the Commission [36].

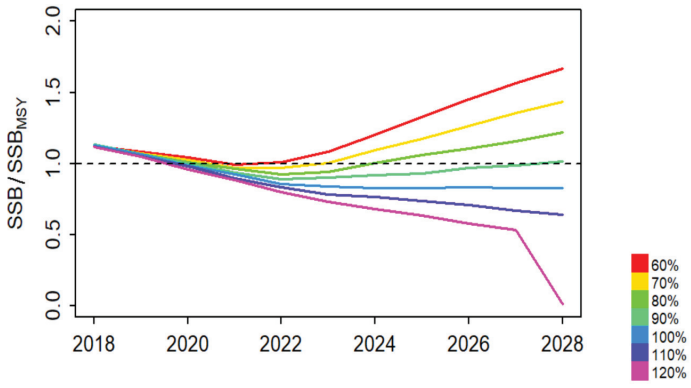

Figure 5. Trajectories of the median stock status between 2019 and 2028. Reproduced from [37], with permission from Indian Ocean Tuna Commission, 2022.

Table 2. Key management quantities from the 2016 SS3 assessment. Reproduced from [36], with permission from Indian Ocean Tuna Commission, 2022.

Management Quantity	Aggregate Indian Ocean
Most recent catch estimate (t) (2015)	93,040
Mean catch over last 5 years (t) (2011–2015)	101,483
h (steepness)	0.7, 0.8, 0.9
MSY (1000 t) (80% CI)	104 (87–121)
Data period (catch)	1975–2015
CPUE series/period	1979–2015
F_{MSY} (80% CI)	0.17 (0.14–0.20)
SB_{MSY} or * B_{MSY} (1000 t) (80% CI)	525 (364–718)
F_{2015}/F_{MSY} (80% CI)	0.76 (0.49–1.03)
B_{2015}/B_{MSY} (80% CI)	n.a.
SB_{2015}/SB_{MSY} (80% CI)	1.29 (1.07–1.51)
B_{2015}/B_{1950} (80% CI)	n.a.
SB_{2015}/SB_{1950} (80% CI)	0.38 (n.a.–n.a.)
$SB_{2015}/SB_{current,\ F=0}$ (80% CI)	n.a.

* The Management Quantities refer to the data used in the last assessment, conducted in 2016.

6. Case Studies on the Influence of Scientific Research in Decision-Making of ICCAT and IOTC

In RFMOs, the connection between scientific research and organization decision-making is mostly related to the determination of the TAC for a specific species in a given year, which will subsequently form the basis for the national quota determined based on the relevant criteria for that specific species to each CPC of that RFMO [38]. In addition, the results of scientific research form the foundation of certain CMMs, such as the coverage rates of observers onboard fishing vessels and the number of fish aggregation devices (FADs) allowed onboard a purse seine fishing vessel. In light of the fact that obtaining a national quota as much as possible is usually the first priority for almost every State in the RFMOs and impacts to the fishing fleet of CPCs may vary significantly due to different regulations in CMMs, it is crucial to understand the role and influence of scientific research in decision-making procedures in RFMOs [39].

In the ICCAT, the determination of the TAC and national quota for BET are the responsibility of Panel 1. After the stock assessment meeting, Panel 1 convened an intersessional meeting of Panel 1, the objective of which was to provide a forum for discussion on the current and possible future management measures related to tropical tunas, including modifications of the current CMMs or adoption of new measures and development of Management Strategy Evaluation (MSE) and Harvest Control Rules (HCRs). Due to the fact that the latest stock assessment results indicated that the status of BET is overfished and subject to overfishing, CPCs expressed a willingness to develop a comprehensive suite of measures to stop overfishing and support the rebuilding of the Atlantic BET stock for two overarching goals, including reducing the catch of BET with scientific advice and reducing the mortality of juvenile BET (<100 cm) [40].

Later, in the 21st Special Meeting held in Dubrovnik, Croatia, several CPCs tabled proposals for revising the current management plan of BET. Despite the fact that these proposals were primarily based on the scientific information provided by SCRS, the limits set in each proposal were different significantly. This was because the scientific data provided by SCRS were not fixed numbers. Taking the TAC of BET as an example, SCRS only provided the projected outcomes subject to different years for recovery (i.e., 10 years or 15 years) and different percentage of success (i.e., 50% or 60%) that the population of BET stock will be restored and recovered to a heathy status (i.e., biomass that enables a fish stock to deliver the maximum sustainable yield or Bmsy). Therefore, the TAC has to be lower if we want the recovery of BET stock in shorter years and a higher successful percentage and vice versa. However, different CPCs have different opinions on how many years for recovery, as well as the favorite percentage for success, and thus, they have different proposed TACs. For example, in the proposal of South Africa, the TAC was 55,000 tons for 2019 [41], but in the proposal of Guatemala, the TAC was 65,000 tons [42]. Panel 1 tried to merge different proposals into one and additionally convened many informal meetings in the margin of the Special Meeting to reach a consensus TAC among the CPCs. Unfortunately, Panel 1 was eventually unable to reach a consensus on a revised management plan for tropical tunas [43].

The determination of the TAC for BET continued in 2019. A 2-day intersessional Panel 1 meeting was held before and in conjunction with the 27th Regular Meeting of ICCAT in November. In the Panel 1 meeting, the opinions for the TAC of BET stock still widely varied, from 65,000 tons to 55,000 tons. Led by Guatemala, Latin American CPCs insisted that the TAC should be 65,000 tons in order to support their development needs, and the United States proposed to have a lower TAC at 55,000 tons to ensure the successful recovery of BET. More importantly, most CPCs agreed and accepted the TAC to be between 60,000 and 62,500 tons, which was a great improvement for CPCs to reach a consensus on this issue. In the 27th Regular Meeting, the Chair of Panel 1 tried to narrow down the gap between CPCs and then proposed 61,500 tons as a middle ground. After several rounds of informal meetings, a revised management plan for BET was finally adopted by all CPCs, including setting a recovery period for 15 years with the goal of achieving Bmsy with a probability of more than 50%. In addition, the TAC for 2019 and 2020 were 62,500 tons and 61,500 tons, respectively, and the TAC for 2021 will be determined based on the results of the stock assessment completed in 2021 [44].

The practice of scientific research in the IOTC is similar to that in the ICCAT, with some but important differences. The status of the Yellowfin Tuna (YFT) stock has been the most concerning issue of the IOTC in the past several years. In its 23rd Session Meeting held in Hyderabad, India in 2019, the Scientific Committee explicitly expressed in the meeting that the evidence available in 2018 proved that the YFT stock was determined to be overfished and subject to overfishing, but it was not able to recommend any concrete catch advice to the Commission due to the uncertainty in the projections. Despite this, however, the Scientific Committee still suggested 403,000 tons as the TAC for YFT in the following years as its advice to the Commission. The Scientific Committee also recommended that the

Commission should ensure catches be reduced to end overfishing and allow the spawning stock biomass (SSB) to recover to the level of the maximum sustainable yield (SSBmsy) [45].

To follow the advice from the Scientific Committee, three proposals to revise the current rebuilding plan of YFT were tabled and discussed during the meeting. Unlike the ICCAT, however, there was no argument for the determination of the TAC because of the fact that the Scientific Committee provided a fixed number of the TAC to the Commission. For examples, the proposals of Korea [46] and the European Union [47] both set 403,000 tons as the TAC for YFT in the following years. Therefore, the determination of the TAC was not an issue during the meeting but how to fairly allocate the YFT quota to each fleet fishing in the IOTC area of competence. Finally, the Commission adopted a compromised resolution incorporating all the proposals mentioned above, in which the quotas allocated to the CPCs were reduced according to fishing gears and the amount of historical catch [48].

7. Discussion

Decision-making is important for the effectiveness of RFMOs for the conservation and management of fisheries resources within their areas of competence. Leroy and Morin (2018) indicated that the effectiveness of the decision-making procedure in RFMOs can be evaluated by (1) blocking or opting-out behaviors constrained, (2) transparency in the objection procedure, and (3) conservation and management measures, including the related dispute resolution process, adopted in a timely manner [49]. Pentz and Kelnt (2018) argued that RFMOs requiring consensus for decisions may lack the ability to practice adaptive management against climate change [50]. Further, McDorman (2005) also pointed out that the relationship between RFMO decision-making and scientific information, evidence, advice, and recommendations demonstrates the central challenge for RFMO decision-making to respect state sovereignty while minimizing the scope of states to hinder the adoption and implementation of management and conservation measures that science and the state of the stocks require. It is also worth noting that many of the directions and principles that are to inform management decisions, for example, the precautionary approach, ecosystem management, protection of biodiversity, reduction of over-fishing, etc., are fundamentally scientific matters and are, or are expected to be, dealt with primarily within the science context [38]. This paper is to identify how scientific research influences decision-making processes in the ICCAT and IOTC.

Based on the above analysis, some observations can be learnt from the practices of scientific research in these two RFMOs. Firstly, scientific research has become an existing practice and plays an important role in the operation and decision-making of RFMOs, particularly in the determination of the stock status, TAC, and the following allocated national quota. Secondly, scientific research, generally in the context of stock assessments, is usually initiated and greatly assisted by the Secretariat of a RFMO, which is primarily responsible for data collection and preparation. Thirdly, participants for stock assessments are mostly scientists in the field of marine biology or fisheries rather than managers or officers from governmental fisheries authorities. Therefore, it is easier for scientists to agree on something based on the scientific data provided to the Scientific Committee, and if not, there will be no voting among scientists but defer the decision to the Chair of the Scientific Committee for ruling. Lastly, data preparations in both RFMOs are very similar, including biology, catch, fishing efforts, and CPUE. Models for stock assessments are also similar, particularly the SS3 Model. Projections are for the reference of the Commission when adopting a CMM.

Particularly, in both RFMOs, the determination of the TAC for a specific fish species is generally based on the results of their respective stock assessments [51]. When determining such a TAC, however, how many years for the recovery/rebuilding plan of that fish stock has to be determined in advance. When a TAC is decided, the Commission will determine the quota for each CPC in this organization based on its respective criteria [52]. However, there are still some differences regarding the practice of scientific research in both RFMOs, such as the final outcome of the TAC discussed in the previous section, which greatly

affects the degree and effectiveness of the results from scientific research to be accepted by CPCs. As mentioned previously, despite the fact that scientific research has become an essential part in a RFMO, the results of scientific research are not always observed when a decision is made in a RFMO. In other words, whether suggestions based on scientific research from the Scientific Committee will be accepted by all CPCs accordingly during the decision-making process is still a question to debate. Such a situation may result from two possible reasons: (1) the mandate of the Scientific Committee/SCRS and (2) how the Scientific Committee/SCRS provides its advice regarding scientific research to the Commission.

For the former, the primary question is that, when in a RFMO, the Scientific Committee, which is responsible to conduct scientific research, only has the mandate to "develop and recommend" to the Commission from the scientific aspect rather than the authority to make final decisions, which happens to both the ICCAT and IOTC. The Commission, the highest decision-making body in a RFMO, is the only part that has the right to make final decisions based on those suggestions and recommendations provided by the Scientific Committee. However, during the decision-making process, the Commission considers not only the scientific aspect but also many other aspects, such as political, economic, and social ones. Setting the quota of a specific fish stock for each CPC is usually the best example in which the TAC recommended by the Scientific Committee is not a problem, but the final TAC will exceed the recommended one due to additional requests from some developing CPCs. For example, when the Scientific Committee suggests that the TAC for BET should be 10,000 tons for the next year, such a recommendation has to be submitted to the Commission for final adoption. The TAC is usually adopted by all CPCs without any problems, but when discussing the allocated quota for each CPC, some CPCs will always have different opinions. On the one hand, coastal CPCs always insist that they are eligible to share a certain amount of the quota whether or not they fish in the Convention area of this RFMO based on the right given by the international laws, particularly UNCLOS. On the other hand, CPCs that are DWFNs claim that they want to maintain the same quota as they were to make sure their fishing industry survives. To accommodate all opinions and requirements from CPCs, the final decision of the TAC will inevitably exceed the suggested TAC provided by Scientific Committee. With these additional quotas or "political quotas [5]", this is why the effectiveness of RFMOs for the conservation and management of high seas fisheries is still questionable and not very promising today [6].

For the latter, how a Scientific Committee/SCRS "advises" the Commission will be the key to whether such a recommendation will be accepted by CPCs without any argument. This is exactly the difference between the ICCAT and IOTC and, thus, results in different outcomes in their decision-making process. In the 26th Regular Meeting of the ICCAT in 2019, the Chair of SCRS reported to all CPCs that SCRS concluded that BET in the Convention area was overfished and was still experiencing overfishing; the latter could be evidenced by the TAC for BET being 65,000 tons in between 2016 and 2018 but the nominal catch for all CPCs was about 72,300 tons in 2016 and about 80,000 tons in 2018, as both were way over the limit of the TAC. Therefore, there was an urgent need for the Commission to renew and adopt its Multi-Annual Conservation and Management Programme for Tropical Tunas to rebuild BET. Thus, as mentioned in the previous section, the Commission should decide the TAC and how long they wish BET to be rebuilt [53].

Generally speaking, in order to successfully rebuild a stock, the probability of not being overfished and not overfishing should be at least greater than 60%. Although a probability of 50% is logically able to rebuild a stock, it will entail a very great risk for the collapse of the stock if an unexpected situation occurs. Based on the calculations of SCRS provided to the Commission, if a 60% probability of not being overfished and not overfishing for BET is reached by 2033, the level of the TAC should be lower than 60,000 tons [53]. However, SCRS did not provide a fixed number for the TAC as its recommendation to the Commission. Rather, it only provided projections with different years of the stock being rebuilt and successful probabilities but deferred the decisions of how many years and successful

probabilities to the Commission. Different years and different successful possibilities will result in different TACs for the following years, which will inevitably become the central questions to be debated in the Commission. For examples, the Chair of Panel 1 and many CPCs, on the one hand, supported that the TAC should be lower than 60,000 tons based on the calculations of SCRS, preferably between 57,500 and 60,000 tons [54]. On the other hand, however, many Latin American CPCs preferred longer years and lower probabilities for the stocks to be rebuilt and insisted that the original TAC of 65,000 tons should be maintained because reducing the TAC in the following years will bring about significant social and economic impacts to their fishing industries and nationals [55]. Furthermore, the European Union proposed a TAC of 62,500 tons as a middle ground, trying to reach a compromise between these two groups [56]. After lengthy debates, the Chair of Panel 1 proposed a gradually reducing formula that was 62,500 tons for the first year and 61,500 tons for the second year and was finally adopted by the Commission [57].

The situation in the IOTC, on the contrary, was not similar to that of the ICCAT. As previously stated, the Scientific Committee of the IOTC did provide a fixed number of TAC for YFT at 403,000 tons, which was agreed on by the participants of the Meeting of Scientific Committee as its recommendation to the Commission. Therefore, despite the fact that several CPCs tabled different proposals for the YFT rebuilding plan, the TAC in these proposals were all 403,000 tons. Although the allocated quota for each CPC remained greatly debated in the following meetings, similar to that of the ICCAT, the TAC for YFT remained unchanged, with the original 403,000 tons agreed on and provided by the Scientific Committee. In other words, the TAC for YFT recommended by the Scientific Committee did not change, and the problems left were how to fairly allocate the quota of YFT to each CPC, which is a social, economic, and political issue rather than scientific one in RFMOs.

In sum, there were many similarities of the ICCAT and IOTC regarding scientific research in their decision-making. The only difference was that the SC of IOTC, in the case of the YFT TAC, provided a fixed number rather than the ICCAT SCRS, which did not provide a fixed number in the BET TAC. Such a difference resulted in significant outcomes when deciding the TACs, including whether significant debates in the negotiation process and "political quota" existed or not.

8. Conclusions

Scientific research has played an important role in the conservation and management of high seas fisheries, particularly after the adoption of UNCLOS. Since then, many international legal instruments have begun to emphasize the importance of scientific research and effective CMMs for the sustainable utilization of high seas fisheries possible, particularly UNFSA. In addition, as the primary cooperative mechanism, RFMOs have been the most important platform in addressing high seas fisheries under the contemporary international fisheries legal regime. In other words, RFMOs are now responsible to ensure the effectiveness of the conservation and management of high seas fisheries, which also includes the responsibility to ensure that scientific research will be properly incorporated into the negotiation and adoption of CMMs.

Based on the practices in the ICCAT and IOTC, scientific research has been part of organizational work without doubt. Similar efforts have been made periodically in the stock assessments for fish species under their mandates in both RFMOs. In most situations, RFMOs adopt decisions on the TAC based on the results of stock assessments conducted and recommended by the Scientific Committee and relevant Working Groups to the Commission, despite the fact that, on some occasions, these recommendations will not be totally accepted and adopted by the Commission. This is, however, not to say that the scientific research does not provide any merit in the work of a RFMO. Rather, the results from scientific research have become the basis for issues related to conservation and management measures discussed in RFMOs, and those occasions are mostly not within the scope of scientific research but social, economic, and political considerations. Along

with that, if the Scientific Committee provides a more explicit and clear recommendation (i.e., a fixed number of the TAC for YFT provided by the IOTC Scientific Committee rather than the range of TACs provided by the ICCAR SCRS) to the Commission and CPCs for determination, it is apparent that these occasions when decision-making is pending or not to be totally accepted and adopted based on scientific research (i.e., political quotas to inflate the final TAC and thus endanger the sustainability of fish stocks) could be less and less in the near future. Therefore, how to enhance the role of scientific research in RFMOs without being affected by political considerations or without a final decision, a key element to ensure the effectiveness of CMMs and sustainable development for fisheries resources, will determine the success of RFMOs for the conservation and management of high seas fisheries resources and is thus worthy of sustained attention.

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The Determinants of Global Value Chain Participation in Developing Seafood-Exporting Countries

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Abstract: Global value chain (GVC) participation has played a significant role in boosting the trade gains of both developed and developing seafood-exporting countries over the past three decades. In addition, the extent of GVC participation has become the most important platform for addressing gains from trade in developing seafood-exporting countries to ensure that their participation enhances economic growth. Recent studies on GVC participation in developing countries have highlighted the importance of domestic institutions. However, the literature is silent on the quality of the domestic institutions–GVC participation nexus. This paper aims to investigate the determinants of GVC participation and the effect of the quality of domestic institutional governance on seafood-exporting developing countries' GVC participation indices. Using the Hausman–Taylor (HT) estimator and the system generalised method of moments (GMM) dynamic panel data methodology to examine seafood export data from 32 countries from 2009 to 2018, we find that economic potential drives backward GVC participation, while low forward participation might not only lead to lower gains from trade, but also limit countries to the supply of primary seafood products with little value addition. In addition, the quality of domestic institutional governance constrains GVC participation. Overall the results indicate that the quality of domestic institutional governance matters for the GVC participation of seafood-exporting developing countries.

Keywords: GVC participation; seafood; system generalised method of moments; Hausman–Taylor; governance; developing countries

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1. Introduction

Seafood exports from developing countries are increasingly integrated into the global seafood market, mainly through global value chains (GVCs). Over the past two decades, the demand for seafood production and processing has increased the number of participating states and territories in the seafood GVC from 200 in 2014 to 221 in 2020 [1,2]. The increasing wave of bilateral trade agreements driven by trade liberalisation plays a significant role in expanding global trade, thereby facilitating GVC participation through the removal of trade barriers, advances in information and communication technologies, and falling transportation costs. With the rise of GVCs, there is now a substantial body of literature indicating that through GVC participation, firms are provided with essential opportunities to access international markets. Furthermore, participating countries can specialise in core tasks, access higher-quality and sophisticated inputs, benefit from new ideas, and transfer technology to stimulate productivity growth and expand the scale of exports [3–5].

In recent years, the seafood GVC has intensified, involving more developing seafood-exporting economies, and covering a broad spectrum of products. This has opened a plethora of opportunities for developing countries to integrate into the global economy through backward and forward linkages. Participating countries can build productive capacity and competitiveness at a lower cost, resulting in derivable benefits, including job creation and poverty reduction, which enhance economic prosperity in countries heavily

participating in GVCs [6]. However, while developed countries have higher participation rates, representing 85% of GVCs in 2014, GVC participation in African and South Asian countries has been very low [7]. Such participation is generally limited to the provision of primary inputs for further processing, with little value addition [8].

Seafood-exporting developing countries have different levels of involvement, as evidenced by the extent of export processing. While some countries export more processed seafood, indicating higher engagement in GVCs—e.g., South Africa, Namibia, and Indonesia—countries such as Madagascar, Tanzania, and the Gambia have more unprocessed seafood exports, indicating little-to-no value addition [9]. What, then, causes different levels of GVC participation in seafood-exporting developing countries? Recent developments on the drivers of GVC participation have led to global studies of GVC enablers in several sectors. These studies highlight factor endowment, foreign direct investment (FDI), market size, labour costs, and tariffs as the main enablers of GVC participation [10,11]. While the literature provides evidence from other sectors, little or no attention is paid to the seafood industry in developing countries. Furthermore, while extant literature focuses on value chain governance driven by lead firms in the seafood value chain, the quality of domestic institutional governance related to the integration of countries into GVCs is neglected. Studies have focused on traceability and ecolabelling [12–15]. Broadly, governance here refers to policies to assure the authenticity of seafood exports, protect endangered species, and reduce the likelihood of illegal seafood exports. However, because the captive value chain governance structure constrains developing countries to a narrow range of tasks, such as simple assembly, captive firms depend on the lead firm for complementary activities such as design, logistics, and process–technology upgrading [16,17]. Therefore, it is crucial to investigate the role of domestic institutional governance in facilitating GVC participation.

Developing countries have distinct GVC governance patterns due to the quality of their domestic institutions [18], which significantly impact GVC participation. The author of [19] identified the importance of functioning domestic institutions to escape captive value chains. Therefore, this study seeks to investigate the effects of developing seafood-exporting countries' institutional governance on GVC participation. Furthermore, we examine the impact of influential determinants of GVC participation in seafood-exporting developing countries by applying a GMM econometric model and the Hausman–Taylor estimator to data from 32 seafood-exporting countries.

To the best of our knowledge, this paper provides the first evidence of the determinants of GVC participation in seafood-exporting countries, using a quantitative approach. The novelty of this paper is that it extends previous research by estimating the extent of involvement and conducting an econometric analysis of possible determinants. The closest contribution to our study is [20], which used a dataset of firms located in Vietnam to establish that firms who adopt international quality standards are more integrated into GVCs, and are more productive than those operating outside the value chain. While Nguyen [20] primarily focused on the determinants of market access in GVCs using a qualitative approach, our study attempts to fill the gap in the literature by identifying the most influential variables that determine GVC participation in seafood-exporting developing countries—including institutional governance—using a quantitative approach.

This study contributes to the empirical literature in two ways. First, we employ a quantitative approach to measure and quantify developing seafood-exporting countries' involvement in GVCs through the backward and forward linkages introduced in [21]. Secondly, we estimate the drivers of GVC participation using an econometric model. This study is relevant for two reasons: First, the determinants of GVC participation could have important implications for future industrial upgrading policies. For example, unprocessed seafood exports can be a catalyst to strengthen industrial upgrading initiatives to enhance gains from trade. Second, knowledge of the drivers of GVC participation could assist policymakers in designing and implementing effective policies.

Existing research emphasises the importance of GVC participation for the economic growth of emerging economies by evaluating GVC governance in terms of transaction costs [22,23]. Consequently, governance in GVCs is driven by three primary factors: the complexity of information and knowledge transfer required to sustain a particular transaction, the extent to which information can be codified, and the capabilities of actual and potential suppliers in relation to the requirements of the transaction—specifically, knowledge and supplier skills [24]. The governance structure influences the degree of control in the value chain. Firms in captive chains increasingly face strict production rules and regulations which, in turn, influence the extent of GVC participation in developing countries with fewer capabilities. Nonetheless, [18] argues that firms with the right domestic conditions to absorb and assimilate new technology will benefit from GVC participation despite the captive governance structure.

While research on the determinants of GVC participation is nascent and growing, a few empirical studies have identified some governance and non-governance factors that drive participation in the seafood GVC. Recent studies [13,25–27] provide strong evidence that non-governance factors such as certification standards, intensification, supply chain transformation, and policy are key drivers of GVC participation in the seafood trade. Notable studies reveal that governance factors such as traceability [12,28], ecolabelling [29], certification standards [14], and polycentric governance [30] play vital roles in countries participating in the seafood value chain. The authors of [31], using panel data from 100 countries, found that factor endowment, liberal trade policies, FDI inflows, and domestic institutional capacity are crucial determinants of GVC participation. Moreover, the impact of these drivers has a greater significance in determining participation than products. Although these drivers do not necessarily enhance participating countries' economies [11], governance-based factors can influence the drivers and dictate the gains from trade by participating countries in the seafood GVC trade.

Governance-based factors consider traceability and certification standards as drivers of the seafood GVC. Previous studies have investigated the role of governance principally in response to illegal and unregulated fishing, stock sustainability, fraud, mislabelling, and unreported fishing [29,32–36]. Using a qualitative methodology and a sample of 30 exporters and traders between 2016 and 2017, [28] showed that enforced traceability dictated by the European IUU regulations enhances GVC participation. Specifically, export quality was determined primarily via backward participation, leading to the higher export performance of Indonesian seafood exports. Consequently, [13] found that traceability is not driven by the need for acceptance, market access, or a price premium for traceable products, but rather is contingent on the internal practices of the Indonesian seafood marketers. The author of [29] showed that a positive relationship exists between transparency, traceability, and seafood labelling. However, while [37] found that transparency has a negative effect on stock sustainability and consumer perception of the value chain in EU countries, [29] found that transparency and labelling positively impact the seafood value chain in developing countries.

Recent studies deriving insight from extant economic theories observe that mislabelling matters for GVC participation. For instance, the high demand and value of the products, coupled with the prospect of financial gains, lead to fraudulent substitution of labels, as observed in the Turks and Caicos Islands [34]. Similarly, [38] offers evidence that mislabelling may be due to the inability to enforce traceability and authenticity. Specifically, the results suggest that exploitation and conservation policies explain mislabelling. However, once controlled for, the GVC is undisrupted.

On the non-governance factors, domestic price and trade liberalisation have been identified as important drivers of GVC participation in seafood value chains. For example, [25] investigated the impact of domestic prices on the integration of Namibian seafood into the global seafood trade. The study used data from between 2008 and 2016, and a hedonic model. The authors found that Namibian seafood exporters receive higher export revenue due to the globalisation of the seafood trade. Their study suggests that domestic price posi-

tively affects GVC participation, and could affect stock sustainability and economic growth. The authors of [39] found trade liberalisation and agreements to be important drivers. Contrary to [39], [40] found that trade liberalisation could cause overexploitation and environmental harm. This suggests that trade liberalisation could have a limiting effect on GVC participation. The authors of [41] used a Cox model to investigate the impact of trade policies on seafood exports from 27 developing countries between 2004 and 2016. They found that trade policies have a positive impact on trade duration. This finding suggests that trade-related policies enhance GVC participation in seafood exports from developing countries. In contrast to the above evidence, which indicates the possibility of a positive relationship between trade policies and GVC participation, other studies [42] find that a lack of policies strengthening infrastructure and storage facilities has a negative impact on the quality of exports, thereby limiting the GVC participation of low- and middle-income countries. The authors of [43] used an input–output (I–O) econometric methodology to investigate the impact of GVC participation on global seafood consumption. They found backward linkages, measured as the biomass production crucial to sustaining domestic production. However, they found a negligible effect on export quality. The authors of [20] found that internal processing standards reflecting technological development significantly determine the Vietnam *pangasius* industry's export quality. This implies a higher probability of GVC participation, and suggests that export upgrading positively impacts GVC participation, as in [44], where stakeholders were found to play a significant role in the functional upgrading of exports.

Conversely, an ethnographic study [45] asserted that participating in luxury seafood value chains leads to the socioeconomic downgrading of the Philippine seafood exports due to weak institutions and financial constraints. The authors of [46] reported that the effect of GVC participation on seafood productivity is higher in seafood firms with backward linkages through access to funds. They asserted that firms achieved better export performance and competitiveness by utilising the mediating effect of funds.

Despite the plethora of studies, the extant literature on the determinants of GVC participation fails to examine the institutional governance in the seafood GVC. Given the peculiarities of governance in African economies, external governance modalities could obscure our understanding of the determinants of GVC participation in developing countries' seafood industries, including Namibia. Although previous studies have neglected the different governance indicators, the authors of [10] employed other variables, such as market size (GDP), FDI openness, population, and policy variables such as tariffs and the rule of law, to investigate the determinants of GVC participation; thus, their study is limited. Moreover, previous studies failed to see the asymmetries in GVC participation. It is essential to understand the effects of domestic institutional governance and provide policy to enhance gains from the seafood trade of developing countries. Therefore, this study bridges this gap by investigating the determinants of GVC participation in seafood-exporting developing countries, and includes variables of institutional governance in determining the GVC participation in developing countries. The remainder of this paper is structured as follows: Section 2 presents the materials and methods; Section 3 discusses the econometric setup and identification strategy; Section 4 presents the results; and Section 5 concludes with policy recommendations.

2. Materials and Methods

2.1. Data and Variable Description

This study used two main databases: the UNCTAD-Eora Multi-Region Input–Output (https://worldmrio.com/unctadgvc/com, accessed on 24 February 2022) database, covering 189 countries for 26 sectors from 1990 to 2018, and the UNTRADE map (http://www.trademap.org, accessed on 24 February 2022). For the study, we used a sample of 32 developing seafood-exporting countries from 2009 to 2018 (see Appendix Table A1). The seafood sector of developing countries is crucial for economic growth and development, and needs to be studied as a key driver enabling countries to achieve the Sustainable

Development Goals (SDGs) [47]. This is the rationale for including these countries in this study. Developing countries reported different levels of GVC participation over the period [10], necessitating the choice of the period to explain the determinants of GVC participation. The variables regarding GDP per capita, financial development, investment in R&D, profit tax rate, and GDP growth rate were extracted from the World Development Indicators (https://databank.worldbank.org/source/world-development-indicators, accessed on 27 February 2022) for 10 years (2009–2018). Governance was accounted for by using data on six indicators (government effectiveness, control of corruption, political stability, regulatory quality, the rule of law, and voice and accountability) sourced from the World Bank's Worldwide Governance Indicators (WGI) database (https://databank.worldbank.org/source/worldwide-governance-indicators, accessed on 8 March 2022). Variables' names, descriptions, and sources are shown in Table 1.

Table 1. Definitions of variables and data sources.

Variables	Definition	Data Source
Dependent Variable		
GVC_{it}	GVC participation index	UNCTAD-Eora database (2018)
Explanatory Variables		
GDP_{ig}	GDP per capita (proxy for economic potential). Data are in constant-price USD (millions) (2009–2018)	WDI database 2021
INT_{ik}	Investment in R&D (proxy for innovation) as a percentage of GDP	WDI database 2021
FIN_{ik}	Financial development. Domestic credit provided by the financial sector (% of GDP) as a proxy for access to credit.	WDI database 2021
GOV_{ik}	Governance (proxy for institutional quality) using seven indicators: control of corruption, political stability, voice and accountability, government effectiveness, absence of violence, the rule of law, and regulatory quality. The data are measured on a scale of −2.5 to 2.5	WGI database 1996–2020
PRT_{ik}	Profit tax rate (proxy for FDI attractiveness). The data are expressed as a % of commercial profits	WDI database 2021
LIB_{ik}	Trade freedom (proxy for trade liberalisation)	Index of economic freedom – Heritage Foundation 2021. Available at http://www.heritage.org, accessed on 20 April 2022.
FDI_{ik}	Foreign direct investment (net inflows % of GDP)	WDI database 2021

Note: WDI (World Development Indicators); WGI (Worldwide Governance Indicators).

2.2. Methods

In order to achieve the objectives of this study, three processes were used, including the GVC participation index, two-step dynamic GMM, and Hausman–Taylor estimation techniques. First, we used the model proposed in [21] to estimate the GVC participation in the seafood industry in the countries of interest. The quantitative input–output analytical approach is superior to qualitative approaches such as the supply chain management framework, partial equilibrium, and gravity models, since it avoids the problem of "double counting" in conventional trade data. Furthermore, it provides a better idea of the gap between value-added and gross trade, without overestimating the value-added content of exports [48]. The GVC participation index has become a popular econometric tool for quantifying a country's overall involvement in GVCs through backward and forward participation [49–51]. The two components of the index reflect the upstream and downstream links in global production chains.

Individual economies participate in global value chains by importing foreign inputs to produce the goods and services they export (backward GVC participation), and by

exporting domestically produced inputs to partners responsible for the downstream production stages (forward GVC participation). Backward GVC participation is the ratio of a country's total gross exports to its "foreign value-added content of exports" (see definition in Section 2.2.1). In global value chains, this is the "Buyer" or sourcing perspective, where an economy imports intermediates to produce its exports. Forward GVC participation is the share of a country's domestic added value that is used as an intermediate input in other countries' value-added exports. It measures the domestic added value of inputs sent to third economies via supply chains for further processing and export. This is the perspective of the "Seller" or supply-side participant in the GVC. Furthermore, it simultaneously measures the trade-in value added by considering the share of foreign and domestic added value in exports. Second, we employed the system generalised method of moments (GMM) to address the issue of endogeneity caused by omitted variable bias, control for autocorrelation, and heteroskedasticity [52–54]. The dynamic nature of the variables and the ability to evaluate distinct effects of the independent variables on GVC participation while controlling for the regressors' endogeneity motivated this method. Furthermore, this approach accounts for variation in time-series data and unobserved country-specific effects [55]. The Arellano–Bond autocorrelation test [56] was applied to check the validity of the set of instruments. In addition, the Sargan test [57] was used to identify the constraints in the presence of heteroskedasticity with the associated t-value, which tests the validity of the instrumental variables accepted as valid instruments for all evaluated equations. Finally, the Hausman–Taylor estimator was used because some explanatory variables were time-varying and others were time-invariant. In addition, some explanatory variables were correlated with individual effects that were not observed. In these instances, the Hausman–Taylor estimator is more efficient than the within estimator, because it permits the inclusion of time-invariant regressors [58].

2.2.1. Capturing GVC Participation

The measure of a country's overall involvement in GVCs can be simultaneously captured, accounting for backward and forward participation. Following [21,49], we define the extent of GVC participation of a country i in sector s and period t as follows:

$$GVC\ Participation_{i,s,t} = \frac{FIVA_{i,s,t} + DEVX_{i,s,t}}{GRE_{i,s,t}} \quad (1)$$

where $FIVA_{i,S,t}$ is the share of foreign added value used in a country's seafood exports, $DEVX_{i,S,t}$ is the share of a country's domestic added value that enters as inputs in the export of other countries, and $GRE_{i,s,t}$ is country i's gross seafood exports. Equation (1) allows us to capture the participation as the "buyer" or "seller". Therefore, it means that a larger value indicates active participation. It also reveals the extent of backwards and forward involvement, with larger values of $\frac{FIVA_{i,s,t}}{GRE_{i,s,t}}$ indicating higher engagement through backward participation, while $\frac{DEVX_{i,s,t}}{GRE_{i,s,t}}$ indicates higher engagement through forward participation. Export is restricted to products with a six-digit level of processing according to the Harmonised System (HS) nomenclature (HS 304 and HS 305) to capture the effects of value addition.

To compute the backward and forward indicators of GVC participation, we used the EORA MRIO database, which provides information on the domestic and foreign shares of intermediates in one unit of output. Using the UNCTAD notations, the information was translated into an I–O matrix as follows:

$$\begin{aligned} x &= T + y \\ x &= Ax + y \\ x &= (I - A)x = y \\ x &= (I - A)^{-1} y = Ly \end{aligned} \quad (2)$$

where x is the gross output, T is the intermediate demand, y is the final demand, I is the identity matrix, A is the technical coefficient matrix, and L is the Leontief inverse. Following the framework proposed in [59,60], we proceeded to estimate the added value embodied in gross trade flow. First, we obtained the Leontief matrix by dividing the identity matrix (I) by the gross output (x). Secondly, the value added per unit of output was obtained by summing across the rows of the (A) matrix and subtracting all of the elements on the diagonal of the square matrix from an identity matrix. We estimated the trade in value added (Tva) by multiplying the two components L and Vas, along with the diagonalised row vector of the total gross exports matrix (X). Having estimated the Tva, backward participation $FIVA_{i,s,t}$ was obtained from the sum of the rows of the Tva matrix, while $DEVX_{is,,t}$ was obtained from the column of the Tva matrix, excluding the diagonal terms, and is given as follows:

$$\begin{bmatrix} Tva^{11} & \dots & Tva^{1n} \\ \vdots & \ddots & \vdots \\ Tva^{n1} & \dots & Tva^{nn} \end{bmatrix} = \begin{bmatrix} Vas^{1} & \dots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \dots & Vas^{n} \end{bmatrix} \begin{bmatrix} L^{11} & \dots & L^{1n} \\ \vdots & \ddots & \vdots \\ L^{n1} & \dots & Tva^{nn} \end{bmatrix} \begin{bmatrix} X^{1} & \dots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \dots & X^{n} \end{bmatrix} \quad (3)$$

2.2.2. Empirical Model and Estimation Technique

Theoretical research on the determinants of GVC participation has highlighted the importance of governance [22,60]. Previous studies [8,31] presented political stability and the rule of law index as proxies for governance, and other variables such as FDI and infrastructure as critical determinants of GVC participation. For this study, governance is adjusted to include three indicators (control of corruption, government effectiveness, and regulatory quality) as proxies for good governance. Following extant studies [31,61], the GMM structure is modelled as follows:

$$GVC_{it} = \beta_0 + \beta_1 GVC_{it-1} + \beta X_{it} + \varepsilon_{it} \quad (4)$$

where $GVC_{i,t}$ is the dependent variable, and represents the GVC participation index; X_{it} is the vector of independent variables for country i at time t; β is a coefficient representing the responsiveness of the respective variables, and ε is an error term that includes country- and time-specific attributes. In addition, the GVC participation index is included with time lags to mitigate the likelihood of reverse causality arising from the probability that countries with greater processed seafood exports establish links within the GVC and, therefore, dominate the chain. In addition to the role of mitigating reverse casualty and omitted variables, the lagged GVC participation index accounts for the time effects of knowledge and technology spillovers on export upgrading. The Hausman–Taylor structure is expressed as follows:

$$GVC_{it} = \beta_0 + \beta_1 X_{1it} + \beta_2 X_{2it} + \Omega_1 Z_{1it} + +\Omega_2 Z_{2it} + \mu_i + \varepsilon_{it} \quad (5)$$

where X_{1it} is a vector of time-varying variables assumed to be uncorrelated with μ_i, X_{2it} is a vector of time-varying variables assumed to be correlated with μ_i, Z_{1it} is a vector of time-invariant variables assumed to be uncorrelated with μ_i, Z_{2it} is a vector of time-invariant variables assumed to be correlated with μ_i, X_{1it} and Z_{1it} are time-invariant instruments that are not correlated with μ_i, μ_i is the time-invariant component of the error term, and ε_{it} is the error term.

3. Results

3.1. The Extent of GVC Participation by Seafood-Exporting Countries

Figure 1 shows the forward and backward GVC participation for the period 2009 to 2018. The highest forward participation is observed in countries with higher levels of GDP, such as Namibia, South Africa, Argentina, India, and Brazil. This means that outputs from these countries are used as intermediaries in international markets. As expected, many

countries—such as Maldives, the Gambia, and Turkey—have lower or negligible levels of forward participation compared to other countries.

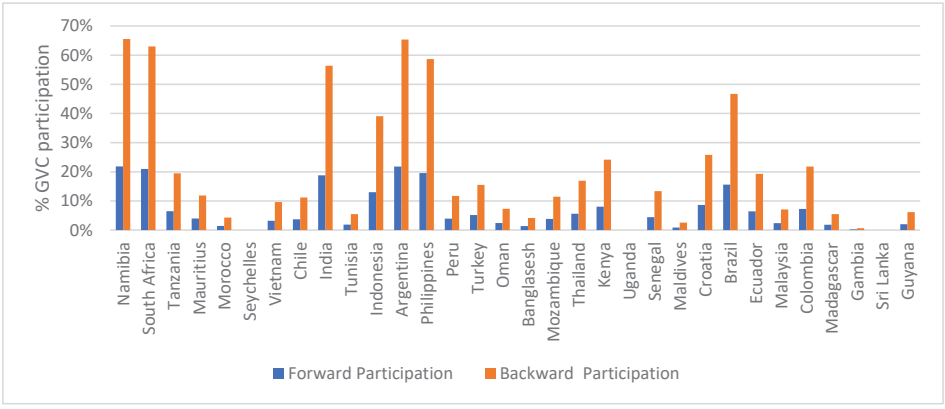

Figure 1. Forward and backward GVC participation (2009–2018). Source: UNCTAD–Eora Multi-Region Input–Output (https://worldmrio.com/unctadgvc/, accessed on 24 February 2022) database.

3.2. Drivers of GVC Participation

Table 2 presents the descriptive statistics for the full sample. We can observe that the potential economic proxy—GDP per capita (GDP_{ig})—has the highest mean of 34.83, followed by foreign direct investment (FDI) (FIN_{ik}) at 25.97 and, lastly, investment in R&D (INT_{ik}), averaging 0.33. The maximum and minimum values for the variables are between 131 and 0.22, respectively. The standard deviation (SD) is 24.39, 0.11, 1.52, and 8.80 for GDP per capita, investment in R&D, governance, and foreign direct investment, respectively, indicating variation in the samples. The skewness has positive values for GDP per capita, foreign direct investment, and investment in R&D, indicating a positively skewed distribution. The quality of institutional governance (GOV_{ik}) has a mean of 6.6, and varies between 2.7 and 8.6.

Table 2. Summary statistics.

Variables	Mean	SD	Min	Max	Variance	Skewness	Kurtosis	Obs
GVC_{it}	9.583	0.895	7.520	10.713	0.80	−3.273	2.035	212
GDP_{ig}	34.834	24.391	6.598	131.130	594.93	1.147	4.782	266
LIB_{ik}	33.478	9.395	16.785	55.821	98.26	0.745	2.793	187
PRT_{ik}	7.727	2.049	2.498	9.807	4.20	−1.024	3.033	227
FIN_{ik}	5.690	1.589	3.290	8.720	2.52	0.610	1.922	227
INT_{ik}	0.336	0.118	0.220	0.490	0.01	0.340	1.238	248
GOV_{ik}	6.614	1.526	2.795	8.679	2.33	−0.744	2.613	217
FDI_{ik}	25.970	8.807	1.873	57.990	77.56	0.914	4.733	262

Authors' estimations.

Table A2 in the Appendix presents the correlation test results between GVC participation and its lag. The results indicate persistence as the lagged dependent variable tends to 1. This implies that developing countries are involved in GVCs, and can self-select into GVCs via quality improvements. Therefore, the system GMM estimator is best suited to deal with heterogeneity, endogeneity from reverse causality, and heteroskedasticity [55].

The diagnostic tests of the models were satisfactorily consistent with the theoretical expectations. The AR (2) statistic, which measures the second-order serial correlation, was not significant. We failed to reject the Hansen test for over-identifying restrictions, and concluded that our set of instruments is valid. The Sargan test for over-identifying restrictions could not be rejected; hence, the instruments are valid, and can be used in the model.

Table 3 presents the results of the Hausman–Taylor estimation and the two-step system GMM for the determinants of GVC participation in the 32 seafood-exporting countries.

Table 3. System GMM estimation.

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**
$I.GVC_{it}$	0.679 *** (0.058)	0.850 *** (0.010)	0.0863 (0.015)	0.976 *** (0.017)	0.907 *** (0.025)	0.848 *** (0.038)	0.939 *** (0.040)
GDP_{ig}	−0.087 ** (0.014)	−0.004 *** (0.000)	−0.003 *** (0.000)		−0.003 *** (0.000)	−0.004 *** (0.000)	−0.002 * (0.000)
LIB_{ik}	0.714 *** (0.480)						0.003 ** (0.004)
PRT_{ik}	0.0249 *** (0.087)		0.028 *** (0.006)	0.020 ** (0.006)	0.036 ** (0.011)		
FIN_{ik}	0.0781 *** (0.632)			0.007 (0.005)	0.044 *** (0.012)		
INT_{ik}	0.9814 *** (0.458)	0.890 *** (0.217)	0.649 *** (0.126)			0.934 *** (0.389)	
GOV_{ik}	−0.914 *** (1.514)	−0.06 *** (0.008)				−0.054 * (0.018)	−0.079 *** (0.016)
FDI_{ik}	0.067 *** (0.0047)			0.008 *** (0.002)	0.002 (0.003)		0.074 *** (0.013)
Observations	108	108	108	108	108	105	105
Instruments		13	13	13	13	13	13
AR (2)		0.046	0.054	0.053	0.032	0.044	0.054
Hansen $p-$alue		0.554	0.594	0.532	0.459	0.350	0.009
Sargan $p-$value		0.145	0.118	0.004	0.089	0.049	0.081

The dependent variable is the lagged GVC participation index; ***, **, and * indicate $p < 0.01$, $p < 0.05$, and $p < 0.1$, respectively. SYS GMM: robust standard errors in parentheses (Windmeijer correction); HT: standard errors (robust) in parentheses. Source: Authors' estimations.

Model 1 presents the results of the Hausman–Taylor estimation. The results reveal that the coefficient on the GVC participation is slightly lower for the Hausman–Taylor estimator, while the coefficients of GOV_{ik} and LIB_{ik} are marginally higher for the latter. The coefficient of FIN_{ik} is also higher in the case of the Hausman–Taylor estimator. The most pertinent difference is that the variables of interest (GOV_{ik} and LIB_{ik}) retain statistical significance. The lag of GVC participation is the dependent variable. As expected, the lag of GVC participation and investment in R&D are the most significant drivers of GVC participation. The GDP per capita has a negative but significant impact. Model 2 presents the results of the impact of investment in R&D on GVC participation in the presence of economic potential. It investigates whether countries that invest in innovation experience higher levels of GVC participation based on financial performance. INT_{ik} is significant and has a positive coefficient, thus confirming that investment in R&D enhances GVC participation [34]. Institutional governance quality has a negative and significant impact on GVC participation in all models reported in Table 3. The profit tax rate has a positive and significant impact on the specifications reported in Models 3, 4, and 5. This suggests that the ability of the seafood sector to attract FDI enhances GVC participation. Trade liberalisation significantly impacts GVC participation in Model 6. This confirms that the removal of tariff and non-tariff barriers—especially in international trade—plays a critical role in GVC participation [31].

3.3. Robustness Checks

The effect of investment in R&D on GVC participation is debated in the literature. Some studies [62,63] argue that the impact of investment in R&D is positive, while others [64] argue that investment in R&D has a negative effect on GVC participation. Nevertheless, investment in R&D could vary depending on the quality of domestic institutional governance. If investment in R&D is affected by poor governance, participation could be low. In Model 6, we control for investment in R&D to check whether the results obtained in Model 7 are due to omitted investment in R&D. The estimated coefficient for governance is still negative and significant, which implies that weak governance limits GVC participation.

Furthermore, it is argued that the availability of funds influences GVC participation in developing countries [65]. Following this argument, it could be that the unavailability of funds is due to the domestic governance structure. In Model 6, we control for financial development. The estimated coefficient for governance is still negative and significant. This implies that governance is a crucial determinant of GVC participation.

4. Discussion

An analysis of the extent of GVC participation of seafood-exporting developing countries found that the forward participation, measured as the share of domestic value added in the exports, was low (Table A3). Over the 10-year period, the forward participation ranged between 0% and 21%, while the backward participation ranged between 5% and 65% (see Figure 1). The current extent of involvement in GVCs highlights how the gains from trade in these countries are driven primarily by backward participation. One possible explanation for the low forward participation could be that developing seafood-exporting countries engage in low-value-added activities. As shown in [10], developing countries' forward participation is mostly in the supply of primary inputs and, hence, might not benefit from integration into GVCs through this channel to improve gains from trade.

According to the non-governance drivers of GVC participation, all indicators were negative except for investment in R&D and foreign direct investment. These results corroborate the findings of [10] and [61] regarding the determinants of GVC participation in developing countries. GVC participation is negatively impacted by the GDP per capita, indicating that the low level of economic development constrains GVC participation. As stated in [66], the higher the GDP, the greater the insertion into GVCs; however, this is only observed when incomes exceed USD 22,000. In countries with low GDP per capita, forward integration into GVCs is negligent. One main reason for the low integration is the industrial structure of the seafood industry. Most of these countries have a low share of seafood manufacturing in GDP, consequently increasing backward participation and reducing forward participation. Among the governance indicators, the profit tax rate and trade liberalisation can be discussed due to the importance of foreign direct investment attractiveness and trade policy to GVC participation. The results reveal that the significant positive impact of both indicators on GVC participation highlights the importance of the potential for GVC participation at higher levels of trade freedom (trade liberalisation) and improved profit tax rates (a proxy for FDI attractiveness).

The findings also indicate that the quality of domestic institutional governance restricts GVC participation. In contrast to previous studies that have focused on traceability and ecolabelling in seafood value chains [13,14], corruption, political stability, voice and accountability, government effectiveness, absence of violence, the rule of law, and regulatory quality are significant factors that can impact seafood GVC participation. According to a previous study [29], mislabelling had the greatest potential of all the governance measures to ensure traceability and authenticity. Therefore, improving institutional governance—especially accountability in seafood regulatory institutions—is vital.

The sensitivity analysis of investment in R&D and domestic credit provided by the financial sector revealed that the quality of domestic institutional governance has the greatest impact on GVC participation. The analysis revealed that the omission of investment

in R&D resulted in a negative impact of governance on GVC participation. In addition, increasing domestic funding also resulted in a negative impact of governance on GVC participation. Therefore, despite the efforts to increase domestic support for developing countries' seafood sectors, poor institutional governance still limits GVC participation. A study of two developing seafood-exporting countries revealed that it is difficult for developing nations to obtain Marine Stewardship Council (MSC) certification, hindering their export performance [67]. Nevertheless, developing nations can improve the quality of domestic governance by controlling corruption, enhancing regulatory quality, promoting accountability, and enforcing the rule of law. Moreover, managerial and non-managerial measures should be implemented to ensure accountability and compliance in order to mitigate the negative effects of poor domestic governance on GVC participation. These measures could discourage corrupt practices and promote honesty and transparency.

5. Conclusions and Policy Recommendations

Participation in global value chains has played a significant role in boosting trade gains, particularly in developing nations. Previous studies have emphasised the significance of backward and forward participation as well as domestic institutions for achieving sustainable gains from trade; however, seafood-exporting countries have varying degrees of integration into global value chains. In addition, as the primary driver of trade gains, the extent of integration into GVCs has been the most important platform for addressing gains from the global seafood trade. Consequently, the present study examines the impact of the quality of domestic institutional governance on GVC participation. We specifically examined the extent of the forward and backward participation, and the determinants of GVC participation of seafood-exporting developing countries.

Our results indicate that the extent of GVC participation—particularly backward participation—is related to economic potential. In addition, low forward participation might result in lower trade gains and limit countries to supplying unprocessed seafood products. Our findings on governance factors have policy implications, especially with regard to the quality of domestic institutional governance. Inadequate domestic governance could be a limiting factor to GVC participation. Hence, policies that inhibit a country's participation in GVCs could be reformed to enhance the integration and improve gains from the seafood trade. Achieving this would require exerting efforts towards gaining better participation and market access through good governance, such as the development of programmes aimed specifically aimed at fighting bribery and extortion, training programmes and disciplinary procedures to ensure staff adherence, proper remuneration of agents, transparency, and non-governance complements such as investment in R&D and foreign direct investment. Other policy recommendations include strengthening seafood institutions. For example, [67] shows that in the case of Kerala, India and the Gambia, West Africa, weak domestic institutions are very significant in explaining the lack of MSC certification and, hence, GVC participation. In mitigating this, institutions have been established with new management structures to coordinate MSC certification procedures and support applications for certification. Since institutions are crucial for MSC certification, the following recommendation is made: that developing countries should consider other non-managerial measures such as policies for addressing stock sustainability, overfishing, and the impact of enhanced fishing on the wider ecosystem.

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Appendix A

Table A1. List of countries in the estimations.

List of Countries			
Namibia	Chile	Turkey	Croatia
South Africa	India	Mozambique	Brazil
Tanzania	Tunisia	Thailand	Ecuador
Mauritius	Indonesia	Kenya	Malaysia
Morocco	Argentina	Uganda	Colombia
Seychelles	Philippines	Senegal	Peru
Vietnam	Madagascar	Maldives	Bangladesh
Oman	Guyana	The Gambia	Sri Lanka

Table A2. Power correlation matrix. Author's estimations.

	lgdpc	L.lgdpc
lgdpc	1.0000	
L.lgdpc	0.9963 (0.0000)	1.0000

Author's estimations.

Table A3. Value-added decomposition of exports.

Countries	Backward Participation (2011–2020)	Forward Participation (2011–2020)	Countries	Backward Participation (2011–2020)	Forward Participation (2011–2020)
Namibia	327,537	109,179	Bangladesh	20,786	6929
South Africa	314,859	104,953	Mozambique	57,346	19,115
Tanzania	97,451	32,484	Thailand	84,462	28,154
Mauritius	59,148	19,716	Kenya	120,848	40,283
Morocco	21,502	7167	Uganda	0	0
Seychelles	0	0	Senegal	66,693	22,231
Vietnam	48,074	16,025	Maldives	13,051	4350
Chile	55,751	18,584	Croatia	129,220	43,073
India	281,851	93,950	Brazil	233,472	77,824
Tunisia	28,494	9498	Ecuador	96,645	32,215
Indonesia	195,272	65,091	Malaysia	35,414	11,805
Argentina	326,781	108,927	Colombia	109,042	36,347
Philippines	293,275	97,758	Madagascar	27,483	9161
Peru	58,646	19,549	The Gambia	3344	1115
Turkey	77,386	25,795	Sri Lanka	0	0
Oman	36,541	12,180	Guyana	30,651	10,217

Source: Authors' estimations, based UNCTAD-Eora database (2018).

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What Do We Need to Do? The Sustainable Development of Chinese Marine Fisheries: A Legal Perspective

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Abstract: Both the nation with rich marine fishery resources and the nation importing marine fishery resources are increasingly attending to the sustainable growth of marine biodiversity and the balanced governance of fisheries. Nevertheless, Chinese marine fisheries have achieved progressively sustainable development from a legal perspective. Initially, the present paper outlines the legal relationship between sustainable development theory and marine fisheries, discusses the current circumstances of Chinese marine fisheries, and reviews Chinese legal regimens governing marine fisheries. Given this context, the paper explores and analyzes the legal issues (legislation, law enforcement, and administrative management) concerning the sustainable development of Chinese marine fisheries. These significant matters are then discussed to advance a potential approach to enhancing the legal systems governing Chinese marine fisheries and ameliorating the sustainable development of such fisheries. The results will serve as a reference to help lawmakers, decision-makers, and practitioners.

Keywords: legal issues; sustainable development; Chinese marine fisheries; legal perspective

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1. Introduction

China incorporates 32,000 km of coastline and about 4.73 million km^2 of sea area [1] and possesses 7372 islands (only about 450 islands are inhabited) with a total area of 72,800 million km^2 [2].Thus, China owns a wide variety of marine resources [3]. Such geographical advantages have turned China into the predominant producer of wild and farmed fish (aquaculture), and the capture fishery is also developed [4]; these advantages have also made China a staunch supporter of extraordinary marine biodiversity throughout the global village [5]. Statistics computed up to the end of May 2022 demonstrate that China has identified more than 20,278 aquatic wildlife species (marine fishes included), 1384 species of fish in inland waters, and 724 species of wetland wildlife. In addition to more than 6000 vertebrate types, aquatic species account for around 70% of China's marine life, and 92 varieties of fish have been classified as extinct, endangered, vulnerable, or rare in the wild [6]. The statistics and environmental features of such resources present the current conditions of Chinese aquatic wildlife species and reflect the unique advantages of the growing marine fisheries in China. China's fishing industry has expanded dramatically over the last three decades. This industry encompasses marine fisheries, and its growth is driven by supportive government policies and the rapidly increasing demand for marine piscaries resources. However, the phenomenal growth in China's fishing industry depended extensively on the overutilization of China's limited fishery resources [7]. Unfortunately, the root cause of the unsustainable fishing industry is mainly attributed to the disputed ownership of regional and other waters [8] and unscientific practices [9], such as illegal, unreported, or unregulated fishing [10]. The difficulties confronting the sustainability of the fishing industry also include the outward expansion of China's marine fisheries [11], the pressures of excessive urban development, ocean pollution, and land reclamation, as

well as rather inadequate fisheries-specific legislation [12]. Such concerns have resulted in the rapid depletion of marine fisheries in China's domestic waters, posing a dire threat to the sustainable growth of Chinese fisheries [7,13].

The Chinese government and relevant practitioners have begun attending to the increasingly severe problems mentioned above. They offered practical solutions from the perspectives of their domains [14,15]. However, the problems mentioned above have generated immense sustainable development challenges for marine fisheries in the combined context of the 21st Century Maritime Silk Road [16] and the quest to build a community that shares a vision of the future of humanity. Therefore, the stated issues must be resolved dynamically and rationally. There is substantial published research on the sustainable development of marine fisheries [17]. Such investigations comprise combinations of comparison studies of the marine governance and legal framework of different nations and the international trade mechanisms involved in the operation of marine fisheries. Most existing Chinese studies on sustainable development are generally limited to comprehensive governance and policy analyses [18,19]. The scant scholarly discussion has targeted legal issues (legislation, law enforcement, and administrative management) pertaining to the sustainable development of marine fisheries. Therefore, the importance and necessity of studying the sustainable development of marine fisheries from the legal perspective are prominently evident.

Given the above context, this paper attempts to contribute to the extant research from the legal perspective of the sustainable development of Chinese marine fisheries. It thus begins with an illustration of the legal associations between sustainable development theory and marine fisheries. It offers a brief overview of the current conditions of Chinese marine fisheries and their evolutionary trajectory, provides updated data analyses, and subsequently examines the legal regimens regulating China's marine fisheries. Additionally, the paper explores the legal issues regarding the sustainable development of Chinese marine fisheries. It evaluates the challenges posed to sustainable development by the current management mechanisms and legal systems governing marine fisheries. The final segment of this paper postulates possible approaches to ensure the sustainable development of Chinese marine fisheries. It also posits new and reformed ideas and practices to ameliorate the sustainable development of marine fisheries from the legal aspect.

2. The Theory of Sustainable Development and Marine Fisheries

This section sequentially scrutinizes the following international instruments and Chinese domestic laws in chronological order for marine fisheries to examine the legal relationships between the theory of sustainable development and the operation of marine fisheries. It determines how sustainable development theory has been applied to legal procedures concerning marine fisheries.

The 1972 Declaration of the United Nations Conference on Human Environment [20], the mooting of Our Common Future in 1987 [21], the Rio Principles adopted in 1992 [22], the Millennium Declaration of 2000 [23], the 2002 Johannesburg Declaration [24], and the 2005 World Summit Outcome Document [25] represent international instruments that can essentially be deemed the soft international law on sustainable development adopted in the context of the United Nations. Without exception, these documents are intended to reinforce the foundations of international cooperation on sustainable development. Notwithstanding the oceans and marine resources mentioned intermittently in these international instruments, none of the documents has focused exclusively on applying sustainable development principles to marine fisheries. The general international standards and practical learning were viewed as equally applicable to the existing legal frameworks for marine governance. Furthermore, the international community has yet to have clear-cut conception of sustainable development. The ultimate consensus goal of sustainable development is to develop and guarantee the survival of human beings and to seek a dynamic balance point between economic development and the eco-environment [26]. To return to the difficulties relating to marine fisheries, a specific interpretation of marine ecological equilibrium theory

essentially connotes sustainable development theory apropos marine fisheries [27]. Sustainable development theory vis-à-vis aspects of marine fisheries are based on the principle of free access to marine biological resources. This tenet incorporates three aspects [28]: the fair sharing of oceanic benefits, the equitable use of marine resources, and the harmonious coexistence of human beings and oceans [29].

The theory of sustainable development also applied relevant international conventions to the marine fisheries industry. The 1946 International Convention on the Regulation of Whaling [30] focused merely on the sustainable exploitation of specific animals, viz, whales. Notably, further measures were mandated by this convention to ensure the scientific protection of the marine environment and other marine fisheries. However, the 1982 United Nations Convention on the Law of the Sea [31] attempted for the first time to establish a common legal framework for the exploitation and conservation of marine resources and the protection of the environment. The preamble of this 1982 convention proposed that the state parties would promote the conservation of their living resources and encourage the study, protection, and preservation of the marine environment. Articles 116–120 and Part XII of this convention stipulate the protection of the piscine resources of the high seas and the preservation of the marine environment. These sections deal with the conservation and management of the living resources of the high seas. The two mentioned international conventions do not clearly specify the sustainable development of marine fisheries. Nonetheless, they display a cross-fertilization between the general notions concerning sustainable development and the fisheries regimes by tackling a gamut of issues, including the protection of particular species or the conservation of public marine resources [32].

The legal concept of sustainable use was first elucidated in the 1992 Convention on Biological Diversity [33]. This convention may be deemed a bid to apply sustainable development theory. The convention outlines its primary objectives as the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits emanating from utilizing genetic resources [34]. Biological diversity is defined as the 'variability among living organisms from all sources including . . . marine and other aquatic ecosystems and the ecological complexes of which they are part' [35]. This convention does not establish particular obligations relating to marine resources. However, it obliges all states parties to the convention to 'implement it with respect to the marine environment consistently with the rights and obligations of states under the law of the sea' [36]. The Subsidiary Body on Scientific, Technical and Technological Advice posited issues relating to the sustainable exploitation of the oceans and marine resources requiring the attention of state parties, including acidification and deep-sea fishing, marine protected areas, and undersea noise [32].

In the present Chinese situation, although the Chinese government has not formulated a comprehensive policy or a single law on marine biodiversity [37], the State Council of the People' s Republic of China (PRC) instituted the National Biodiversity Strategy and Action Plan, the National Marine Functional Zoning Plan, the 13th National Five-Year Plan for Marine Economic Development, and the National Plan for Marine Ecological and Environmental Protection in succession before 2020. The four national instruments offer a general framework and guidelines for marine biodiversity conservation in China. Taking the specific example of marine fisheries, sustainable development essentially embodies the policy idea of a circular economy that requires the exploration and exploitation of marine fisheries based on a harmonious relationship between human beings and the seas [38]. It also requires minimizing the pollution of the marine ecological environment and the destruction of marine fisheries resources.

On 11 March 2021, the 14th National Five-Year Plan for National Economic and Social Development was enacted [39]. Under the instruction of this plan, the whole status of the Chinese marine ecological environment is steadily improving, which manifests two aspects related to sustainable development: on the one hand, the overall condition of marine ecosystems has greatly improved, with typical marine ecosystems monitored in

a healthy or sub-healthy state; on the other hand, the environmental quality of the main sea-using areas is generally good, and while protecting the marine ecological environment, it also provides firm support and protection for the development of the marine economy.

In addition, the Ministry of Ecology and Environment, the Development and Reform Commission, the Ministry of Natural Resources, the Ministry of Transport, the Ministry of Agriculture and Rural Affairs, and the China Marine Police Bureau jointly issued the 14th National Five-Year Plan for Marine Ecological Protection on 17 January 2022 [40]. This plan can be regarded as the latest guideline for marine biodiversity conservation in China, which provides the following measures:

(1) Improving and perfecting the laws, regulations, and responsibility system for marine ecological and environmental protection, promoting the construction of an ecological and environmental governance system that integrates land and sea, strengthening the marine ecological and environmental regulatory system and regulatory capacity and establishing a sound marine ecological and environmental governance system with clear authority and responsibility, multiparty governance, smooth operation, coordination, and efficiency.

(2) Taking scientific and technological innovation as the driving force and implementing the concept of marine community of destiny, promoting international cooperation in marine ecological and environmental protection, effectively implementing international conventions on marine ecological and environmental protection, and actively participating in global marine ecological and environmental governance.

(3) Clarifying the importance of strengthening organizational leadership and increasing investment protection, strict supervision and assessment, and strengthening publicity and guidance.

It can be seen that the above six national instruments have made a comprehensive plan and specific arrangements for marine biodiversity conservation.

The two principal questions about Chinese marine fisheries from the viewpoint of sustainable development can be summarized as emphasizing the policy and legal aspects of the sustainable development of marine fisheries. The Chinese government and the State Council have taken tangible measures over the last four decades to resolve the two questions from practical and legal perspectives:

(1) How can marine fisheries resources be appropriately utilized?

(2) How can marine fisheries in China be legally protected and managed?

The solutions to the first and the second questions are mainly reflected in the following series of national policies and Chinese domestic laws, respectively [41].

In addition, the Chinese government has also instituted five policy objectives in order of priority [7]:

The first and most important policy objective is ensuring the supply of fishery products, including high-quality proteins for human consumption and raw materials for related industries.

The second and third objectives are enriching fishermen's lives and earning foreign reserves. Development in the marine fishery sector can contribute to fishermen's income growth; given the comparative advantage of China's marine fishery sector, it has great export potential, generating foreign reserves for the country.

The fourth objective is protecting the marine environment through sustainable fishing. Overfishing, pollution, and introduced species have had devastating effects on the marine environment. On the other hand, sustainable fishing practices—including constructing artificial ocean reefs, restocking, improving water quality, and other measures—contribute to protecting the marine environment.

The fifth objective is to serve the country's political and strategic interests. It is recognized that promoting the development of the marine fishery sector will contribute to safeguarding China's maritime interest in the disputed waters. Furthermore, a distant-water fishing fleet will enable China to expand fishery cooperation with the international community and contribute to China's international strategy.

Given these, the sustainable development of marine fisheries is not the top priority of the policy objectives but to ensure the supply of fishery products and enrich fishermen's lives. The last two policy objectives manifest the long-term sustainable development objective based on accomplishing the first and the second. Therefore, the implementation process has no conflict between the above policy objectives.

Policies relating to the legal protection and management of marine fisheries have been successively formulated to denote the sustainable development requirements for marine fisheries by the Chinese legislatures and the State Council as follows:

(1) The fishing license system [42] refers to fishing license issuance based on the status of marine fisheries resources. The number of fishing licenses issued is determined based on biomass and total allowable catch [43]. Although this system positively controls marine fisheries operation and production, it neglects to protect marine fisheries resources.

(2) The minimum mesh-size regulation [44] and the 'double control system' [45] aim at controlling the marine fishing intensity and properly utilizing marine fisheries resources. The two policies provide a chance for China to restore its marine fisheries' biodiversity and ecosystem.

(3) The implementation of the series of following policies (summer moratorium of marine fishing [46], the limits on marine fishing vessels and fishing gears [43], fishery improvement programs [47], and the establishment of artificial reefs and aquatic germplasm resource protection areas [45]) aims to better fulfil the goal of the sustainable protection and development of marine fisheries resources.

In addition, the departments administrating fisheries not only promote implementing these policies based on the legal system of Chinese marine fisheries but also have moderately restricted the use of marine fisheries resources to protect economically valuable fishery assets and other organisms by preventing damage to their environment during the fishing process, for example, headed by Zhejiang and Fujian provinces in southern and eastern China, the launched marine nature reserves represent a step toward the sustainable development of marine fisheries. The administrations governing fisheries of the provinces generally controlled fishing methods and limited fishing gear with a focus on protecting juvenile fish and ensuring the capacity to renew marine fisheries resources; they have taken the above policies to gradually recover the ecological environment scientifically [48]. The positive effects manifest not only the environmental improvement of internal water but also the sustainable development of Chinese marine fisheries and the protection of internal waters by implementing those Chinese domestic laws. Legal efforts to support the sustainable development of Chinese marine fisheries range from implementing the 1982 Marine Environment Protection Law [49] and the 1986 Fisheries Law [50] to enacting discrete administrative regulations. Such endeavors evidence a legal relationship between Chinese marine fisheries and their sustainable development.

3. The Development Status of Marine Fisheries Resources in China

Historically, Chinese marine fisheries have evolved from an initial and accelerated phase to the current intermediate and steady stage, revealing China's dynamic implementation of discrete development and management policies at different growth stages of the industry. This section chooses the period of 2010 to 2020 as the time samples in this research and a selected quantity of catches and aquaculture production, the number of fishers, and the number of vessels involved in the fisheries, which reflect the development status of marine fisheries resources in China. In this section, the first two stages briefly summarize and analyze the statistics of China's fisheries before 2010, which can be found in the yearbook of Chinese fisheries. Much more attention in the last two stages is focused on analyzing the latest statistics of the recent decade and more.

The initial stage (1949–1978) witnessed two historical events in contemporary China: the establishment of the PRC and the launch of reforms accompanied by the adoption of the opening-up policy. The Chinese government also began to attach great importance to exploiting marine resources via fisheries to aid post-war reconstruction and drive economic

growth [51]. Although the fishing and loading methods were crude and outdated in this period, the development of internal water fisheries initially characterized the government-leading model, which largely facilitated fisheries production development and greatly satisfied the Chinese society's demand for material wealth. The total production of fisheries increased from 524,000 tons in the early years of the Republic of China to 3,489,000 tons by the end of the First Five-Year Plan [52]. However, the use of marine resources for fisheries developed slowly between the First Five-Year Plan to the eve of China's adoption of reforms and opening up because of various political campaigns. The aggregate production of Chinese fisheries was maintained at around 3 million tons, and the fisheries industry stagnated or even experienced a decline in that period [53].

The accelerated stage (1978–2000) witnessed the institution of the above policies and laws oriented primarily toward facilitating the exploitation of fisheries resources and ensuring the growth of the marine economy [54]. Meanwhile, the Chinese governments at all administrative levels offered financial support to local fishing communities and companies to expand their marine fisheries activities [11]. Fishing capacities increased rapidly with such measures, propelled by the massive influx of new fishing personnel and a new wave of shipbuilding [55]. The fishery licensing system and registration system were also established to comply with the requirements of the times, which not only regulate the market of marine fisheries but also promote the smooth development of Chinese fisheries. Between 1979 and 1999, the number of full-time and part-time fishers was augmented by one million and 440,000, respectively. The number of motorized marine fishing vessels increased by 53.37% at this stage, while the annual catch escalated by 35.74% [56]. Thus, Chinese marine fisheries witnessed an immense increase in catches and production, which was achieved through the overutilization of China's marine resources [7]. This stage of practice reveals that an increasing number of fishing boats and fishing professionals exploited marine fisheries resources at this juncture and reflects that the methods used by marine fisheries to exploit resources gradually evolved during this period from traditional fishing to new types of fish farming. Unfortunately, the backward technology of marine fisheries and unrestricted fishing caused a significant decrease in Chinese fishery resources.

Chinese marine fisheries entered an intermediate stage after 2001. The Chinese government has signed increasing numbers of bilateral fisheries agreements with its neighboring nations [57], which forced domestic fisheries management to be changed, resulting from conforming to the basic requirements of these bilateral agreements and exploring the possibility of further cooperation with these nations on marine fisheries. Under this circumstance, the relevant domestic laws concerning the protection and management of marine fisheries have been revised in succession. The consequence of the changes was further increasing the pressures on coastal fishing from legal and management perspectives, which reflects how to solve the contradiction between development and environmental protection to achieve sustained and steady economic growth.

In this context, the Chinese government had also to reconsider the trade-offs between socio-economic and conservation goals [58]. Later in 2006, the Chinese government first asserted the goal of managing marine fisheries in the 'Program of Action on the Conservation of Living Aquatic Resources of China' [59]. This document demonstrates the Chinese government's efforts to find a balance between economic development and ecological sustainability concerning marine fisheries. The Chinese development philosophy has also gradually shifted under this program from emphasizing economic growth to prioritizing ecological conservation, steadily advancing the reform process. Resource conservation has thus become a priority for managing marine fisheries in China [56]. Consequently, a series of amending laws and policies supporting reforms in national fisheries have been enacted and promulgated in succession.

The following section discloses conclusions about the steady stage from data derived from qualitative research methods and subjected to statistical data analyses (2010–2021).

The annual catch output represented the primary barometer for measuring China's success in developing marine fisheries and for assessing the performance of the government

departments charged with fisheries-related matters [60]. Statistically, the total output of marine fisheries increased from 0.6 million tons in 1950 [61] to 1314.78 million tons in 2015 [62]. The catch output during this period depended principally on increasing fishing efforts to manage resources for marine fisheries [45]. However, a progressive decrease has been observed in the total marine fisheries output since 2015. By 2020, this number had dropped to 947.41 million tons [63]. In terms of distant-water fisheries catches, and freshwater catches, the distant-water fisheries catches have shown a general fluctuating trend since 2013. However, the development of distant-water fishing was a practical approach emphasized by the Chinese government to address domestic demands, mitigate the supply imbalance of fishery products, and provide work for fishers [7]. Freshwater catches have also presented a decreasing trend since 2017 [63]. It should be pointed out that the development of distant-water and freshwater fisheries inevitability involves the issues of the exclusive economic zone and the continental shelf. However, China enacted its Law on the Exclusive Economic Zone and the Continental Shelf (EEZ/Continental Shelf Law) in 1998 after it had ratified the United Nations Convention on the Law of the Sea in 1996 [64]. By so doing, the Chinese government has formally established a legal regime for its exclusive economic zone and continental shelf. The development of distant water and freshwater fisheries benefited from this legal regime. Nevertheless, China has much to do in implementing the EEZ/Continental Shelf Law at the domestic and regional levels. At the domestic level, given that the EEZ/Continental Shelf Law is a legi generali, it needs a set of detailed administrative regulations (lex specialis) for its implementation.

Although the following catches were steady for the 11 years reported but fluctuated and presented a decreasing trend in catches in Chinese waters, the essential facts and data materials illustrated in Figure 1 demonstrate the almost decade-long recession in China's fishing output. Complicated policy and management aspects and the law have caused such a situation. These factors have exerted both positive and negative effects. First, the decline of marine fisheries resources has comprehensively illustrated that overfishing and misuse of marine resources, coastal land reclamation, and industrial pollution have, over time, restricted the development of China's fisheries sector. The sustainability of marine fisheries cannot be guaranteed. Second, the increasing demands for marine fisheries resources and the deterioration of the ecological environment make sustainable fisheries development complex and challenging despite China's implementation of policy reforms for the management and development of fisheries.

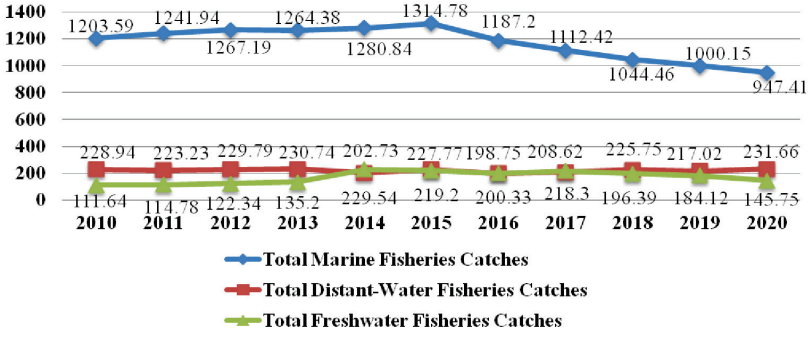

Figure 1. Fish Catches Production 2010–2020 (Million Tons).

From the perspective of fishery production, the annual Chinese fisheries production includes the output of both freshwater and mariculture fisheries. The rapid expansion of the output of fisheries, which now contributes almost three-quarters of China's total marine production, has also ranked topmost for over 30 consecutive years [65]. This achievement not only benefits from the support of the above policies and laws but also relies on the fact that every province has strengthened its capacities for disaster prevention and mitigation and has improved the cultivation of fish farming. Mariculture production has increased

from 0.15 million tons in 1954 [66] to 2065.33 million tons in 2019, maintaining constant growth [67]. However, the recent pandemic, habitat destruction, resource use conflicts, and biodiversity decline caused the total output of fisheries to decline in 2020. Although the freshwater fisheries production of 2020 also decreased slightly vis-à-vis 2019, the main development trend remained smooth (Figure 2) [63].

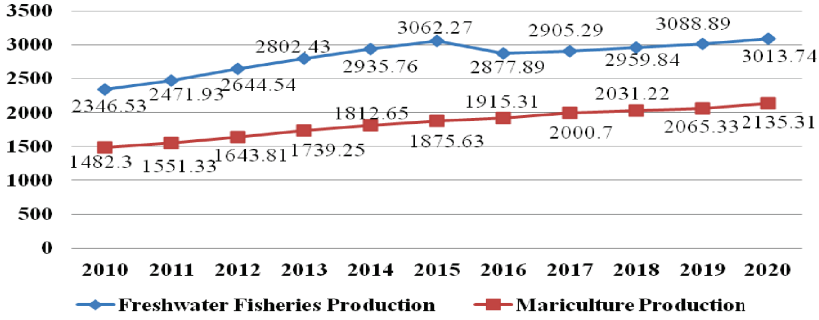

Figure 2. Fishery Production 2010–2020 (Million Tons).

Marine fisheries represent the magnitude of the sector in China in terms of numerical values. Millions of fishers have lived and worked along China's coasts for several generations. The total number of fishers increased gradually but annually before 2010 [68], demonstrating that practical demands for the exploitation and utilization of marine fisheries resulted in the growth of fishers. The income differences between fishers and farmers attracted peasant workers from China's inland provinces to join the marine fisheries in increasing numbers [7]. Marine fisheries resources are renewable; nonetheless, they have been highly exploited and utilized at or close to their maximum sustainable limits: marine resources for fisheries are depleting despite being renewable [69]. Thus, an irreconcilable contradiction exists between the demands for the exploitation and utilization of marine resources for fisheries and their sustainable development.

Additionally, the rising costs and the changing fisheries management policies have significantly affected the livelihoods of the traditional fishers in China. Some fishers have abandoned their generational occupations and have had to move away from their homes, change jobs, and work for tour operators or the service industry. Therefore, the total number of fishers decreased from 2012 to 2020 (Figure 3) [63].

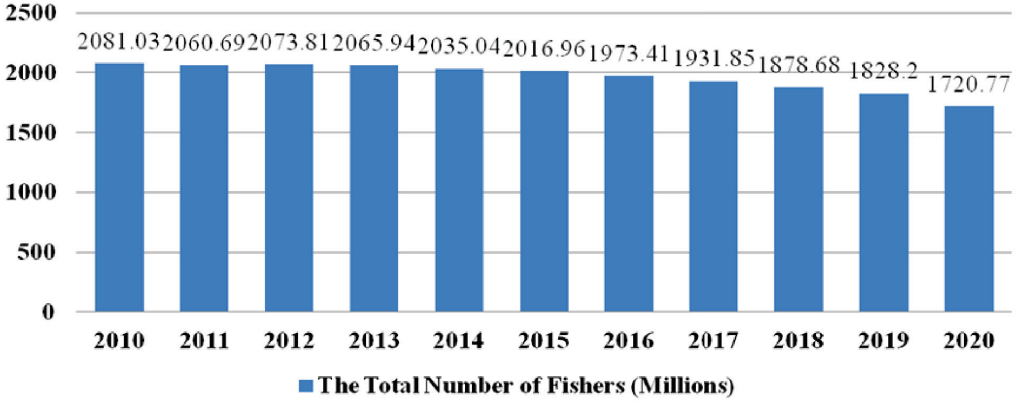

Figure 3. The Total Number of Fishers 2010–2020 (Million).

The data presented in Figure 4 exhibit the year-on-year changes in the number of Chinese fishing vessels, which reflects that the aggregate of fishing vessels (engine-powered

and non-powered fishing boats) has also declined over the last seven years (2014–2020) [63].

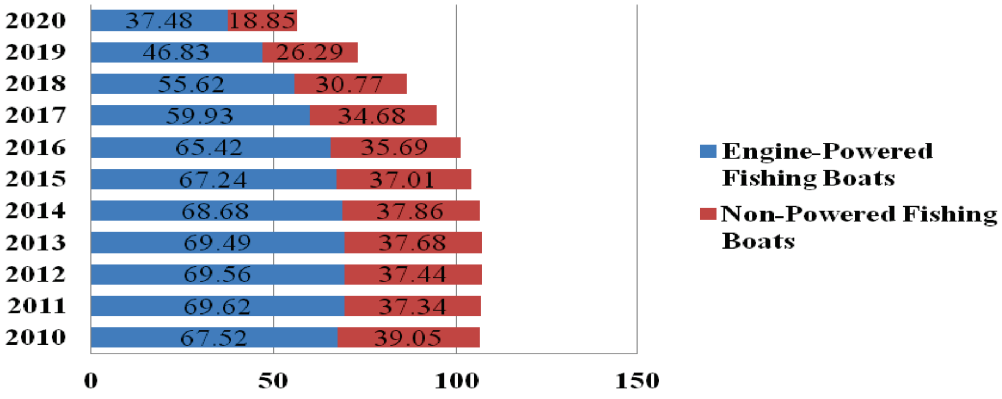

Figure 4. Total Fishing Vessels (Million Ships).

The root cause of a slight annual decrease in engine-powered and non-powered fishing boats lies in the adjustment of national tax policy. Since introducing the reduction and transfer of tax policy in 2006, China decided to abolish the agricultural tax and started subsidizing agricultural production; as a sub-sector, marine fisheries receive financial support through a fishing fuel subsidy. Parallel to the phenomenal increase in China's agricultural subsidy during the same period, the fishing fuel subsidy increased yearly [70]. Meanwhile, the Chinese government not only encourages the downsizing of engine-powered and non-powered fishing boats but also offers much more subsidies to every ship downsized. In contrast, under the fishing fuel subsidy, fishermen will merely receive less than RMB 1500 per kilowatt per year in some areas [71]. If a fishing boat owner participates in the government ship-reduction program, he/she can get only two years of the fishing fuel subsidy [70]. Given this, although the fishing fleet's average size and horsepower improved significantly, the number of the two types of fishing boats has been decreasing because of conflicting fishing subsidies provided by the government [7]. Additionally, the number of engine-powered fishing boats still significantly exceeds that of non-powered fishing boats. This situation directly reflects the implementation of marine fisheries management. The utilization rates for engine-powered fishing boats are higher than for non-powered fishing boats because the former is propelled by high-powered diesel engines and includes electronic equipment for navigation and detecting fish schools. The utilization of different fishing vessels can also reflect the fishing output. Overall, the Chinese government achieves the quantitative target of reducing the total number of fishing vessels [72] and indirectly reveals the diminishing marine fisheries resources by implementing zero and negative growth policies and strategies targeting double control [73].

The marine fishing industry is critical for economic development, income generation, and employment in the coastal areas of China. Traditional generational fishers are extremely dependent on income from fisheries [74] (Figure 5). Incomes from fisheries rose rapidly in 2012 after the industry breached the RMB 10,000 mark in 2011 (Figure 5) [75]. Survey data projected fishers in coastal provinces and disclosed the obvious income gap between coastal and inland regions. This income difference has attracted an increasing number of regular farmers from the inland provinces to join the fishing industry along the coast. Notably, the proportions of income in fishing households also show a rising trend through the increasing efforts of varied national policies introduced to benefit fishers.

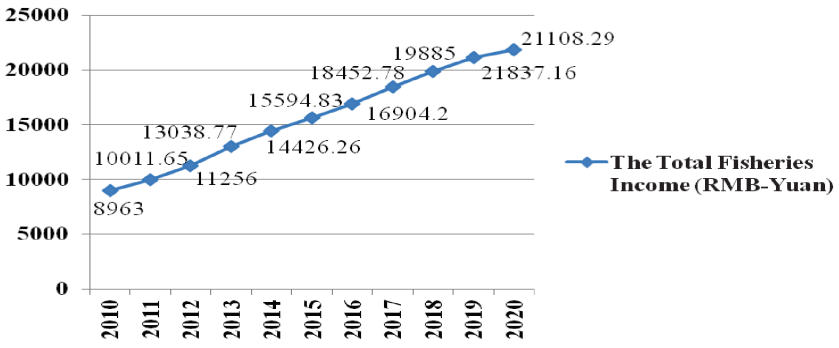

Figure 5. Total Fisheries Income (RMB-Yuan).

4. Legal Regimes Governing Chinese Marine Fisheries

The legal framework forms the core element of official fisheries protection as an organized industry. It governs fisheries and tackles subjects associated with the rights and interests of fisheries, their protection and law enforcement. It also denotes the systematic legal protection of fisheries operations [1]. In brief, the current Chinese legislation on protecting marine fisheries resources represents a combination of laws and regulations relating to their protection and management, as well as to the sustenance of their ecological environments. China's national legislature has enacted diverse national statutes, and the relevant departments administrating fisheries have formulated a series of administrative regulations and measures to improve the management of the marine fisheries resources. However, the ideal effects were not achieved in practice. The sustainable development of marine fisheries requires much more effort to be expended on constructing the rule of law.

4.1. Domestic Laws and Regulations

Chinese laws concerning protecting and developing marine fisheries can be traced to 1955. The State Council issued the Order Concerning Motorized Trawler Fishing in the Prohibited Zones. The zones cover the Bohai Sea, the Yellow Sea, and the East China Sea [76]. This order aimed merely to handle disputes between state-owned and private fisheries and protect China's regional fisheries resources. The ban was widely regarded as the beginning of a comprehensive rule of law governing marine fisheries. The year 1979 represented another breakthrough, launching the reform and signifying the opening up of legislation on marine fisheries. Four temporary legal instruments were instituted in that year to effect a transition in a bold attempt at Chinese legislation: the State Council successively issued the Regulations on the Protection of Aquatic Resources Reproduction [77], the Provisional Regulations Concerning the Work of Fisheries Management [78], the General Order on the Protection of Reservoir Safety and Aquatic Resources [79], and the Provisional Regulations Concerning Fishery Administration [78]. These instruments laid the ground for the subsequent amelioration of the fisheries protection system and gradually introduced legislation that positioned Chinese marine fisheries on the right track.

China first embedded the state's duty to protect its natural resources in the Constitution in 1982 [49]. Article 9 of the Constitution does not directly iterate the rational use of marine fisheries and the protection of marine resources; nevertheless, the years that followed saw the proliferation of legal protection from none to substantial and a commensurate growth of marine fisheries. This advancement reflected the specific evolution of legislation based on Article 9 of the Constitution. National Chinese statutes directly bear the preservation and development of marine fisheries; the most relevant are the 1982 Marine Environment Protection Law [50] and the 1986 Fisheries Law [54].

The Fisheries Law is the most significant applicable national statute. It was passed on 20 January 1986 at the 14th Session of the National People's Congress and its Standing Committee and came into force on 1 July 1986. This law established specific rules for the

utilization and protection of fisheries resources, as well as for the protection of the lawful rights of fishing professionals [80]. The detailed rules for implementing the Fisheries Law (Detailed Rules) were also promulgated in 1987 [81]. The Fisheries Law is still effective after four substantial amendments and functions prominently in the protection and development of marine fisheries. This law further refined the basic direction of the development of fisheries. It clarified the primary pathway for the protection of the rights and interests of fisheries rights by providing a legal basis for the governance of fisheries by law.

The fisheries system in China can be divided into two legal frameworks concerning Chinese marine fisheries. From the perspective of fisheries administrative systems, the State Council has, under the legal framework of legi generali (the Fisheries Law), issued various lex specialis in regulating the matter of marine fisheries. The following regulations cover the 1990 Water Quality Standard for Fisheries [81], the 1998 Regulation on the Fisheries Administrative Penalty [82], the 2003 Quality and Safety of Aquaculture Regulations [83], the 2018 Provisions on the Administration of Fishing Licenses [84], and the 2020 Provisions for the Administration of Pelagic Fishery [85]. These lower-level laws have not only constructed fisheries administrative systems from the holistic perspective of governance, regulating various administrative actions of marine fisheries, but also encompassed the relevant fields and focused unprecedentedly on protecting marine fishery resources. The distinctions among the regulations manifest the different subjects (governments and fishermen) and objects (administrative actions involved in marine fisheries), stipulating the different rights and obligations.

From the perspective of protecting the fisheries' environmental system, the State Council issued the 1993 Regulations of China Governing Survey of Ships and Offshore Installations [86], the 1997 Regulation on Inspection of Vessels and Marine Installations [87], and the 2000 Supervisory and Administrative Punishment Regulation of Navigation in Fishing Ports [88]. These legal regulations aim to eliminate its adverse effects on the ecological environment to further protect the fisheries' environment and obtain both ecological and economic benefits.

The two legal frameworks focus on the different fisheries systems by presenting the above-mentioned Chinese laws and regulations. From then on, a relatively systematic legal regime for protecting and developing marine fisheries gradually takes shape.

4.2. International Conventions

It is impossible for any state in the present interconnected world to solely reconcile the economic development of fisheries with the protection of marine ecology. Thus, the international community has continuously attempted to draft international multi-treaties and enhance international cooperation. China has ratified two multilateral conventions on marine fisheries protection, including the 1982 United Nations Convention on the Law of the Sea and the 1992 Convention on Biological Diversity. These two international conventions provide state parties with standard rules for protecting and developing marine fisheries and stipulate an international rule of law for Chinese fisheries. China has also sought to sign bilateral agreements with other nations. By the end of 2021, China had signed bilateral cooperation agreements with over 27 nations to protect marine fisheries [89]. Two points require special notice: first, the signatories include developed and developing nations, as well as China's neighbors; second, most signatory nations are parties contracted to the United Nations Convention on the Law of the Sea and the Convention on Biological Diversity.

These conventions are instrumental in enhancing the protection of China's marine fisheries and promoting their sustainable development. However, the practical effects of the two conventions are somewhat limited. The intrinsic flaws of the international instruments per se and the varied problems of the Chinese legal system may be deemed predominant reasons for the current unsatisfactory situation. First, the existing international legal regime is too fragile to safeguard marine fisheries around the globe. Neither the United Nations Convention on the Law of the Sea nor the Convention on Biological Diversity provides substantive, specific uniform laws to regulate marine fisheries. Therefore, it is inevitable

that they cannot effectively resolve the myriad issues confronting marine fisheries. Second, Chinese domestic and international laws are currently in conflict. China has undertaken the international obligation to reform its domestic legal regimes and implement the two international conventions. However, the current Constitution does not provide the means to resolve the disputes between Chinese domestic law and the two international conventions. A legal solution was available before abolishing the General Principles of Civil Law on 1 January 2021: international treaty stipulations prevail over Chinese domestic law when in conflict [90]. Unfortunately, the Chinese Civil Code adopted on 28 May 2020 also failed to include any provisions regarding the relationship between international and domestic laws. Therefore, China essentially handles this issue on a case-to-case basis. Finally, the sustainable development and conservation of marine resources depend on holistic measures comprising policy-making, legislation, and scientific conservation [37]. The achievement of the targets established by the two conventions requires effective policy and regulatory measures to be adopted in domestic laws. However, each state applies a different emphasis and confronts divergent difficulties in adopting comprehensive policies and measures.

5. Legal Issues on the Sustainable Development of Marine Fisheries

As previously mentioned, apropos legal regimes governing marine fisheries, the legal system has essentially accomplished the historical task of 'ruling fisheries by law'. Nonetheless, a particular gap exists between achieving the sustainable goal of 'promoting fisheries by law' and 'protecting fisheries by law'. China finds itself at a crossroads, as is graphically illuminated by the legislative developments vis-à-vis the protection of marine fisheries. Generally speaking, legal issues on the sustainable development of Chinese marine fisheries primarily comprise three types of issues:

(1) Those related to law-making,
(2) Those associated with law enforcement and administration,
(3) Those vested in legal liability.

5.1. Issues in the Law-Making

It is posited that the current legal system regulating marine fisheries may be compared to an airplane with two wings: the Marine Environment Protection Law and the Fisheries Law. A series of administrative regulations and measures to improve the management of marine fisheries resources constitutes the fuselage. This airplane may appear sturdy, but the comprehensive legislation on the protection and development of Chinese marine fisheries lacks integral planning and encompasses numerous legal blanks.

First, the Marine Environment Protection Law and the Fisheries Law evince discrete emphases and weaknesses. The former lays particular stress on the prohibitive stipulations apropos the impact of human activities on the marine environment rather than the general provision of resources for marine fisheries. The Fisheries Law also deals with issues concerning marine fisheries; however, this law cannot tackle the increasing changes in the varied aspects of fisheries. The Marine Environment Protection Law has also not achieved the objective of establishing a legal connection with the Fisheries Law, precluding the appropriate construction of a scientific and legal framework for the protection and development of Chinese marine fisheries. The Marine Environment Protection Law does not incorporate relevant provisions about marine fisheries' resource utilization. For example, Article 20 of Chapter 3 of the Marine Environment Protection Law (Amendment 2017) stipulates the protection of endangered marine organisms as an essential aspect of conserving the resources of marine fisheries. However, it does not mention the protection of marine fisheries. In addition, fishing operations are quite harmful to the marine ecological environment. Article 28 of this law merely provides for mariculture rather than the entire fishing industry [91]. It is thus evident that the two existing laws lack the necessary internal relevance and logic.

Furthermore, the legislative purpose and the basic principles of the current Fisheries Law need to clearly articulate provisions pertaining to the principles of sustainable devel-

opment. This situation does not match the Marine Environment Protection Law and does not help China's quest for the sustainable development of marine fisheries [92]. Given the current circumstances, the relationships between general and special laws also cannot be reflected in the legal relationship between the Marine Environment Protection Law and the Fisheries Law.

Second, the independent legal status of marine fisheries is far from being realized in China. Marine fisheries are a distinct category, and differences are mandated in their protection approaches, sustainable development orientations, operational procedures, and standards. However, the legal norms governing Chinese marine fisheries encompass the legal framework regulating all fisheries. The enactment of most Chinese laws on marine fisheries is based on the agricultural perspective rather than special consideration of marine fisheries management [69]. Additionally, most legal norms regulating marine fisheries are selected and integrated from existing domestic laws and thus exhibit piecemeal legislative characteristics [1]. Such circumstances expose the necessity of contemplating an independent legal status for marine fisheries rather than providing general provisions for this industry within the ambit of the Fisheries Law and other regulations.

Third, the Fisheries Law and Detailed Rules constitute the most relevant legal provisions concerning marine fisheries and cannot be ignored. These instruments have been revised numerous times but continue to encompass substantial difficulties. The Detailed Rules merely offer precise definitions of terms such as 'internal waters', 'all other seas under the jurisdiction of China', and 'fisheries waters' [93]. The Detailed Rules do not specifically define 'fishery resources', 'offshore waters', and 'distant waters', hampering the conceptual clarity of legislation pertaining to the sustainable development of marine fisheries. The current status of resource utilization by China's fisheries is to gradually increase the scale of offshore mariculture and encourage the development of distant-water fishing. The Fisheries Law introduces the concept of offshore fishing, and the Detailed Rules advance the concepts of offshore water and open-sea fish farms. In this context, offshore and distant waters should be scientifically defined to enable the Fisheries Law and the Detailed Rules to function more effectively.

5.2. Issues in Law Enforcement and Administrative Management

Examining the legal framework governing Chinese marine fisheries and the state of the relevant fisheries resources in China provides evidence that the Chinese government has elevated the legal status of marine fisheries through various legislative actions. However, enforcing Chinese marine fisheries laws entails a decentralized and fragmentary administrative system. Such dispersion further generates law enforcement and management problems relating to China's legal system and administrative efficacy. The Chinese government has consistently strengthened law enforcement and management to enhance the protection of marine fisheries. In practical terms, however, China's marine fisheries are not effectively protected or sustainably developed.

The issue of administrative law enforcement power over China's marine fisheries is most responsible for the deficiencies mentioned above. Article 3 of the Fisheries Law states that fishery supervision and administration shall be subject to unified leadership and graded administration by the state. However, Articles 6, 7, and 8 of the Fisheries Law allocate law enforcement authority. It is self-evident that fishing activities on inland waters should be monitored and directed according to their administrative divisions by fisheries departments at regional governments at or above the county level. Fisheries-related administrative departments, inspection offices for marine fisheries, and supervisory institutions connected with the fisheries administration can exercise law enforcement powers vis-à-vis the management of marine fisheries resources. Nevertheless, the boundaries between authority and mutual legal responsibility remain indeterminate, and the practical enforcement process is multi-departmental and is not effectively conducive to execution.

Conversely, situations may arise when multiple departments could shift the responsibility of law enforcement to each other, which would also not be conducive to the sus-

tainable development of marine fisheries. In practice, the lack of a holistic perspective and planning leads to poor coordination between administrative departments at all levels. Hence, management is difficult and ineffective because it is uninformed. The excessive decentralization of the authority and responsibility of administrative departments has significantly weakened law enforcement pertaining to fisheries. For example, there are no clear and unified provisions on procedures for issuing fishing licenses.

Second, the management of marine fisheries is currently based on a management hierarchy encompassing the Fishery Administration of the Ministry of Agriculture, local marine fisheries authorities, and the State Oceanic Administration [94]. This structure is beneficial because it allows the existing administrative platform and administrative means to be fully utilized to guide and manage the marine fishing industry. However, the marine fisheries industry is market-based. While the existing administrative hierarchy can adequately achieve the macro-level regulation of fisheries (meaning the extensive and holistic measures of fishery regulation, which focuses on policies and institutions of general application significance), it is less effective in adopting micro-level governance pathways (the legislation, law enforcement, and monitoring mechanisms). Specifically, the inadequate monitoring mechanisms for marine fisheries reflect driving benefits, supervision and management inadequacies, and the poor enforcement of laws. For example, heavy fishing remains prohibited despite amendments to the Fisheries Law and the introduction of regulations on fishing practices. That the existing fisheries management mechanism does not consider private fishers and their legitimate interests is a primary reason affecting the rational exploitation of fisheries resources. In addition, Article 22 of the Fisheries Law states that the state should determine the total fishable amount of the fishery resources and implement a fishing quota system using the principle that fishing quantities should be lower than the increasing quantum of fishery resources. Unfortunately, the implementation of this principle shows the disadvantages of being too rigid. The strict enforcement of seasonal fishing embargoes only temporarily mitigates the deterioration of fishery resources and can lead to a surge in fishing efforts after the closure period [1].

Third, the disparities in the grass-roots law enforcement of marine fisheries pose various problems. The grass-roots law enforcement endeavors about marine fisheries are funded by local governments, whose financial situations and the importance they attach to marine fisheries resources determine the funding available for enforcement. Areas displaying poor economic conditions and regions that do not attach importance to the protection of marine fishery resources would allocate less funding and thus contribute directly to the ineffectiveness of resource management for local fisheries. Besides, the shortage of professional and technical staff and backward law enforcement equipment also currently weaken the safeguarding and law enforcement mechanisms necessary for the sustainable development of marine fisheries.

5.3. Issues of Legal Liability

The penalty provisions outlined in the chapter on legal liability in the Fisheries Law are listed from Article 38 to Article 49. These articles focus primarily on violations of the fisheries management system and provide penalties for the use of illegal fishing methods and fishing during periods banning fishing or designating areas closed to fishing. The Detailed Rule also stipulates specific penalty provisions for the implementation of the Fisheries Law. The following issues concerning legal liability persist despite these provisions.

First, the provisions do not stipulate the legal responsibility of the marine ecological environment and pollution accidents caused by marine fisheries, which are to be pursued under the Marine Environment Protection Law. This case is typical and not isolated: the provisions of legal liability and legal penalty are scattered under different laws. That legislative acts concerning marine fisheries do not adequately tackle the legal liability of marine fisheries is further illustrated.

Second, the current types of administrative penalties stipulated are quite simplistic. Corresponding legal liability is specified for restrictive and prohibitive provisions. On the

contrary, legal regulations should supervise the entire process of fishing operations and auxiliary fishing activities. There are no corresponding penalties in the present law for all fishing-related 'three-nothing' (no ship name and ship number, no ship certificate, no port of registry) vessels. This situation should attract enough attention and must be resolved in an amendment to the Fisheries Law.

Third, the fines and penalties stipulated for the current stage do not correspond with the growing levels of socio-economic development. Hence, fines must be appropriately increased.

6. Possible Approaches to the Sustainable Development of Chinese Marine Fisheries

The above illustration and analysis of the legal issues vis-à-vis the sustainable development of Chinese marine fisheries allow the recommendation of enhancing the legal protection mechanisms of marine fisheries resources as follows:

Chinese lawmakers can take a two-step approach to adopt a gradual legal reform scheme because of the current decline of marine fisheries resources and the illegal development of the marine fisheries industry.

The first step would entail the enhancement of the legislative standards and the improvement of the interface between the current domestic laws and regulations before satisfying the conditions of mature legislation. Significantly, both the Marine Environment Protection Law and the Fisheries Law are essential to the sustainable development of Chinese marine fisheries, which will determine the sustainable development of the marine fishing industry. The Marine Environment Protection Law is required to elucidate the concept of marine fishing; however, it should also add a chapter focusing on the protection of marine fisheries. The Fisheries Law should remain consistent with the Environmental Protection Law and the Marine Environmental Protection Law. The legislative purpose of the Fisheries Law includes promoting the sustainable development of marine fisheries resources, and the basic principles of sustainable development of marine fisheries resources should be established in the general section of the Fisheries Law. However, the legal principles are generally not directly applicable. It is necessary to introduce sustainable development for the legislative purpose and establish sustainable development principles for future legal provisions relating to marine fisheries resources. If possible, lawmakers could consider instituting a chapter to regulate marine fishing, allowing the specific and concrete implementation of marine resource management suited to the current contexts of marine fishing. Furthermore, integrating the legal regulations relating to the exploitation of fisheries resources into the Fisheries Law would make it easier for the administrative authorities to enforce the Fisheries Law, facilitating the sustainable development of marine fisheries resources.

In the second step, the imperfections in the legal system would directly affect the enforcement framework. The lack of comprehensive regulation of the protection of marine fisheries resources would inevitably lead to the imposition of stop-gap measures. It is thus necessary to offer a unified regulation by introducing a law on the protection of marine fishery resources based on the consolidation of existing legal norms established for marine fishery resources. Both ideas and approaches can apply to the legislative design of the Marine Fishing Law.

The strengthening of law enforcement efforts to develop and manage marine fisheries cannot be overemphasized from the perspective of law enforcement. The sustainable development and management of marine fisheries should be adapted in practice to the Chinese situation and should not simply be centralized or decentralized. Specifically, the solution to problems confronting law enforcement of marine fisheries may be reforming administrative institutions. Lawmakers could initially consider the institution of an integrated law enforcement department in the Fisheries Law. For instance, a unified law enforcement department could exercise the powers and functions of different administrative departments. Such an authority can stop and punish policy or regulation violations in the name of a particular administrative department. In addition, the established unified law enforcement department can effectively integrate fisheries management, fishing port

supervision, fishing vessel inspection, and even administrative powers related to protection and sustainable development according to local requirements. Hence, administrative powers can be exercised more systematically, scientifically, and efficiently, precluding conflicts emanating from overlapping law enforcement powers and becoming more conducive to the sustainable development of Chinese marine fisheries resources.

Additionally, a joint law-enforcement mechanism can be gradually inserted into the Fisheries Law from the aspect of the institutional system. The joint enforcement approach can effectively integrate the varied resources of administrative enforcement, facilitate the coordination of the enforcement relationship between various administrative organs, and improve enforcement efficiency. Joint law enforcement does not involve the transfer of administrative powers and does not entail the interests of diverse administrative organs, making it more operable in reality.

From the perspective of the safeguarding mechanism, the sustainable development of marine fisheries resources cannot be achieved without sufficient funds, professional and technical personnel, and technical equipment. Therefore, establishing a safeguarding mechanism for marine fishery resources is crucial for sustainable development.

Legal measures may be adopted as follows: first, the central government should legislate to allocate special funds to the marine fisheries authorities in coastal areas. In addition, central and local finances could jointly support and encourage the local research and development of technologies to sustain marine fisheries resources. Second, legislation should designate local funds for the sustainable development of marine fisheries resources, which regional financial allocations may bolster. Local governments could offer funds to support the sustainable development of marine fisheries resources and include funds for the sustainable development of marine fisheries resources in their budgets. Third, the current Fisheries Law could establish a safeguard mechanism for marine fisheries resources and build supporting scientific research institutions and laboratories.

Legal liability provisions are essential for the sustainable development of marine fisheries resources. Legal liability denotes the use of punishment to regulate the behaviors of fishers, enterprises, and administrative and enforcement personnel. Punishment is not an end in itself, but it is necessary to guide marine developers and managers to promote the sustainable development of marine fisheries.

The legal responsibilities of fishers and enterprises should be further clarified in a future amendment to the Fisheries Law. Different subjects could be assigned discrete legal responsibilities according to different roles, acts, and aftermaths.

The fishing-related 'three-nothing' vessels should be confiscated. These vessels could also be dismantled on the spot, blocking their access to the production process.

The legal lag is embedded in the flaws of the current laws. The types of administrative penalties should also increase, and the punishments for transgressing marine fisheries should be amplified. Fines should be raised, and penalties should increase with socio-economic development.

7. Conclusions

The sustainable development of marine fisheries represents an essential component of the marine biodiversity system and denotes an indispensable aspect of the objectives of the 21st Century Maritime Silk Road. The current Chinese legislation reflects the diverse issues pertaining to the development and conservation of marine fisheries. However, the present study proposed potential approaches to the sustainable development of Chinese marine fisheries by recommending ameliorations to the relevant law-making efforts, strengthening the administrative framework, and suggesting stringent legal liability provisions. In addition, this paper fully demonstrates the importance of strengthening marine and fishery knowledge learning and research and proposes that we should strengthen and improve relevant systems to improve the scientific research level of marine and fishery research institutions. However, policy-related and institutional issues cannot be ignored in the near future; these aspects should also intensively address the sustainable development of

China's marine fisheries. Implementing sustainable development initiatives for marine fisheries in China is still nascent. It remains to be seen whether lawmakers, decision-makers and practitioners are prepared for prospective challenges.

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Inheritance and Development: The Evolution and Overview of China's Fisheries Legal System

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Abstract: China's legal system governing fisheries in China has been stable during development. In line with China's national conditions and the spirit of the times, they have adhered to the concept of green development and maintaining the sustainable development of fishery production activities. Studying the history of Chinese fishery law is beneficial for the world to understand the evolution of this legislation and is a better gateway for the world to understand fisheries law with Chinese characteristics. Fishery, in this context, refers to fishing and fish farming. In China, fisheries are under the management of the Ministry of Agriculture and Rural Affairs, while fisheries enforcement has a special law enforcement department for collaborative management. Therefore, both fishing and fish farming in China's fisheries industry belong to the category of agriculture. This is different from the West and is precisely what makes China unique. This paper explores the Chinese fishery legal and general legal systems by investigating policy guidelines, laws, and regulations on China's fishery industry since 1949. Furthermore, it analyzes the development process of fisheries. Organizing the development status of China's fishery legal and regulatory system analyzes the problems of fishery production control and development, searches for paths and methods to solve the practical problems, and finally, makes a reasonable outlook on the development prospect of China's fishery.

Keywords: China's fisheries legal system; development process; development status; problems; development prospects

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1. Introduction

China is a largely agricultural country, and fisheries are an important industry in the agricultural and rural economy, an important way to implement the rural revitalization strategy, and an important element in the construction of ecological civilization [1]. Since 1949, China's rule of law has gradually improved after more than 70 years of development, and the legal system has been gradually stabilized. Fisheries laws and regulations refer to the sum of legal norms relating to fisheries, i.e., the collective term for legal norms that regulate various activities and relationships relating to fisheries. With the development of the fishery economy, China's legal system has continuously improved. To date, the revision of the Fisheries Law of the People's Republic of China (hereinafter referred to as the "Fisheries Law") has continued to advance, and the development of China's fisheries legal system will face new opportunities and challenges.

2. Legal Review: The Process of Development of China's Fisheries Legal System

The development process of China's fisheries law and regulation system can be divided into four stages according to time: the first stage was the period of gradual fisheries legislation from 1949 to 1960, which was the budding stage of the fisheries law and regulation system and mainly relied on policies and administrative regulations to regulate and guide fisheries production activities; the second stage was the period of stagnation of fisheries legislation

from 1960 to 1976, during which the third stage is the period of recovery and comprehensive development of fisheries legislation from 1979 to 1990, during which fisheries legislation was frequent and the level was improved compared with the previous period, and a system of fisheries laws and regulations was initially formed; The fourth stage is the period of adjustment and further strengthening of fisheries legislation from 1990 to the present, during which fisheries legislation reached a high level of technology, and the fisheries legal and regulatory system was improved on the basis of the previous ones.

2.1. Period of Progressive Fisheries Legislation, 1949–1960

In February 1950, the First National Fisheries Conference was held in Beijing, which formulated the "recovery-oriented" approach to fisheries production, which served to guide fisheries production activities and regulate fisheries management to a certain extent [2]. In 1953, the Third National Fisheries Conference proposed a new working policy. "Steady and focused development of marine fisheries, expansion of freshwater aquaculture, strengthening the management of State enterprises, increasing the volume of fishing, further developing mutual assistance and cooperation in fishery production, improving technology, increasing production per unit area, launching a patriotic and productive campaign: organizing public and private forces, improving processing, transportation, and marketing, and striving to increase the production of aquatic products. The key word in the guidelines has changed from "restoration" to "improvement", indicating that China's fishery production activities have been well developed under the first guidelines. Although these guidelines were not laws and regulations, they promoted the development of fishery production activities and, to a certain extent, played the role of legal regulation and guidance. On 12 July 1957, the Ministry of Fisheries of the People's Republic of China issued the Instruction on the Handling of Intrusion of Fishing Vessels into Closed Areas; on 16 August 1957, the Ministry of Fisheries of the People's Republic of China issued the Supplementary Provisions on the Notification of the Order of the State Council on the Closed Areas of the Bhai Sea, the Yellow Sea and the East China Sea for Machine Vessel Trawling Fisheries [3]. This series of administrative regulations issued by the State Council specifically addresses fisheries activities and is an important guarantee for the orderly conduct and rapid development of fisheries production activities in China.

2.2. The Period of Pause in Fisheries Legislation, 1960–1976

During the period from the founding of the People's Republic of China to the reform and opening up of the countryside, China's freshwater aquaculture production was affected by changes in policy, which led to the shrinking of the aquaculture industry during the period 1959–1961, when the country was extremely tight on food, there was a famine and many places fenced lakes to make fields and filled ponds to grow food. To increase the amount of fishing, the Ministry of Fisheries proposed a large number of emergency measures, which broke the original regulations on the protection of aquatic resources in the summer and autumn when fish reproduction and growth were in full swing, and had a devastating impact on fishery resources. As a result of the policy, legislative activity during this period came to a virtual standstill, and no laws or regulations regulating fisheries production activities emerged, making this a period of pause in fisheries legislative activity.

2.3. Period of Restoration and Full Development of Fisheries Legislation, 1979–1990

On March 16, 1978, the State Council decided to establish the State Administration of Fisheries to restore freshwater aquatic resources and to establish and improve the relevant fisheries laws and regulations [4]. In 1979, the State Administration of Fisheries issued the Interim Provisions on Certain Issues of Fisheries Licenses, under which fishing operators were required to apply for a license from the fisheries administration before they could carry out production. In 1979, the State Council Environmental Protection Leading Group, the State Planning Commission, the State Economic Commission, and the State Administration of Fisheries jointly promulgated the Standard for Fishery Water Quality, which imposed

financial liability and a deadline for the treatment of fish resources harmed by polluted waters. After the 1980s, a series of policies for the development of fisheries were adjusted. In 1981, China adopted the principle of restoring, developing, and improving freshwater fish farming. In March 1982, the National Freshwater Fishery Working Conference was held, which clarified the implementation of the right to use fish farming water and improved the production responsibility system. In 1985, the CPC Central Committee and the State Council issued the In January 1986, the Standing Committee of the Sixth National People's Congress of the People's Republic of China adopted the Fisheries Law, the first Chinese law specifically designed to regulate fisheries production activities; to better apply the Fisheries Law and further regulate fisheries production activities, on 20 October 1987, the Ministry of Agriculture, Animal Husbandry and Fisheries issued the Rules for the Implementation of the Fisheries Law of the People's Republic of China [4]. Through the above series of institutional reforms, policy changes, and legislative activities, China's fishery production activities have seen unprecedented development, and a system of fishery laws and regulations has gradually taken shape.

2.4. 1990 to the Present, a Period of Restructuring and Further Strengthening of Fisheries Legislation

Although the system of fisheries laws and regulations has taken initial shape, there are still many areas that need to be improved and strengthened. Since 1986, the Fisheries Law has undergone four revisions, in 2000, 2004, 2009, and 2013, to better adapt it to national development policies through continuous adjustments to Fisheries Law. To achieve sustainable and healthy development of the fisheries economy, the Standing Committee of the National People's Congress, the State Council, and the Ministry of Agriculture and Rural Development have carried out a series of legislative activities. In addition to focusing on production priorities such as fishing and breeding, aquatic seed breeding, disease prevention and control, aquatic product quality management, fisheries resources conservation, aquatic scientific research, fishing ports, and fisheries safety, construction of fisheries law enforcement equipment systems and fisheries diesel subsidies have also been strengthened in a focused manner, addressing some of the difficulties in fisheries development.

3. Summary: Current Status of the Development of China's Fisheries Legal System

Since the promulgation and implementation of the Fisheries Law, especially as China has entered a new stage of development, the national regulation of fishery production activities is more scientific and reasonable, and China has established the development policy of giving priority to aquaculture, farming, and fishing, and processing, and regulating and managing fishery production activities following the law to achieve the purpose of promoting the sustainable and healthy development of China's fishery economy. In 2021, the total national aquatic product output was 66.902 million tons. The total national aquatic product production was 66.902 million tons, an increase of 2.16% over the previous year. Among them, aquaculture production was 53.941 million tons, up 3.26% year-on-year; fishing production was 12.959 million tons, down 2.18% year-on-year [5]. Table 1 shows that the ratio of aquaculture products to fishery products is 80.6:19.4; the output of seawater products was 33.872 million tons, up 2.20% year-on-year, and the output of freshwater products was 3.305 million tons, up 2.11% year-on-year. The ratio of marine products to freshwater products was 50.6:49.4.

Table 1. Fishery laws and regulations classification by content.

1. Basic Law on Fisheries	1. Fisheries Act (published and implemented in 1986, amended in 2000, 2004, 2009, and 2013) 2. Regulations for the Implementation of the Fisheries Act (issued in 1987) 3. Law of the People's Republic of China on Property Rights (enriches the legal sources of fisheries rights and provides the basic legal basis for effective protection of fisheries rights)

Table 1. *Cont.*

2. Legislation on fishing production	1. Chapter III of the Fisheries Act Fishing 2. Regulations for the Implementation of the Fisheries Act 3. Regulations on the Management of Fisheries Fishing Licence (promulgated in August 2002 and amended in 2004, 2007, 2010, and 2018) 4. Other departmental regulations and normative documents relating to operational avoidance, construction of fishing vessels, fishing-related "three-no" vessels, fishing permits, etc.
3. Legislation on the conservation and management of fisheries resources	1. Chapter IV of the Fisheries Act on the enhancement and protection of fisheries resources 2. Relevant provisions of the Implementing Regulations of the Fisheries Act 3. Order on the Closed Areas for the Bhai Sea, the Yellow Sea, and East Sea Machine-Trawl Fisheries (1955, 1957 Supplementary Provisions) 4. Opinion of the State Council and the Central Military Commission on the Delineation of the Line of the Closed Area for Bottom Trawling by Motorized Fishing Vessels off the Coast of the South China Sea and Fujian Province, as Transmitted by the State Bureau of Fisheries (1980) 5. Measures for the Collection and Use of Fishery Resources Enhancement and Protection Fees, Regulations on the Management of Yangtze River Fisheries Resources Regulations on the Conservation of Living Resources of the Bhai Sea, Regulations on the Administration of Aquatic Life Enhancement and Release, etc. 6. Departmental regulations and normative documents on marine seasonal fishing moratoriums, fishing closures in the Yangtze River, Pearl River, and Yellow River, minimum mesh size, amicability standards and juvenile fish ratios, aquatic ectoplasm resource reserves, and many other aspects 7. Outline of Action for the Conservation of Aquatic Life Resources in China
4. Legislation on farming	1. Chapter II of the Fisheries Act Farming 2. Relevant provisions of the Implementing Regulations of the Fisheries Act 3. Relevant provisions of the Animal Epidemic Prevention Law, the Drug Administration Law, the Rural Land Contract Law, the Sea Area Use Management Law, the Agricultural Products Quality and Safety Law, and other laws 4. Administrative regulations such as the Regulations on the Administration of Veterinary Drugs and the Regulations on the Administration of Feed and Feed Additives Regulations and normative documents of the Ministry of Agriculture relating to the management of quality and safety of agricultural products, management of feed and feed additives, animal epidemic prevention and quarantine, veterinary drug management, etc. 5. Regulations specific to aquaculture management, such as the Measures for the Management of Aquatic Fry, the Regulations for the Management of Aquaculture Quality and Safety, the Measures for the Registration of Licenses for Aquaculture in Waters and Beaches, and standards and norms for water quality for aquaculture, safety limits for fishery feed, use of fishery drugs, and limits for fishery drug residues in aquatic products (mainly after 2000) 1. The Fisheries Act has only basic principle provisions (Articles 32, 34–36) 2. Environmental Protection Law, Marine Environmental Protection Law, Water Pollution Prevention and Control Law, Environmental Impact Assessment Law—the basic legal basis for ecological, environmental protection in fisheries waters 3. Regulations on Environmental Protection for Offshore Petroleum Exploration and Development, Regulations on Administration of Marine Dumping, Regulations on Prevention of Pollution and Damage to the Marine Environment by Pollutants from Land-based Sources, Regulations on Prevention of Pollution and Damage to the Marine Environment by Coastal Engineering Construction Projects, Regulations on Prevention of Pollution of the Environment by Shipbreaking, Regulations on Prevention of Pollution of the Marine Environment by Ships, Rules for the Implementation of the Water Pollution Prevention and Control Law—Protection and Management of Ecological Environment Involving Fisheries Waters 4. "Fisheries Water Quality Standards" (GB11607-89), "Regulations on the Method of Calculating Fishery Losses in Waters Pollution Accidents," "Regulations on the Procedures for Investigating and Handling Pollution Accidents in Fisheries Waters", "Measures for the Administration of Qualifications for Investigating and Identifying Fisheries Pollution Accidents", "Code of Practice for Reporting Information on Pollution Accidents in Fisheries Waters and Emergency Handling"—Fisheries Waters Specific Bases for Handling Pollution Accidents 5. Regulations and normative documents related to marine environmental management, such as marine special protected areas, also address environmental protection and management of fisheries waters

Table 1. *Cont.*

5. Regulations on ecological protection and management of fisheries waters	1. Chapter II of the Fisheries Act Farming 2. Provisions of the Implementing Regulations of the Fisheries Act 3. Provisions of the Animal Epidemic Prevention Law, the Drug Administration Law, the Rural Land Contract Law, the Sea Area Use Management Law, the Agricultural Products Quality and Safety Law, and other laws 4. Regulations on the Administration of Veterinary Drugs and the Regulations on the Administration of Feed and Feed Additives etc. 5. Regulations specific to aquaculture management, such as the Measures for the Management of Aquatic Fry, the Regulations for the Management of Aquaculture Quality and Safety, the Measures for the Registration of Licenses for Aquaculture in Waters and Beaches, and standards and norms for water quality for aquaculture, safety limits for fishery feed, use of fishery drugs, and limits for fishery drug residues in aquatic products (mainly after 2000) 1. The Fisheries Act has only basic principle provisions (Articles 32, 34–36) 2. Environmental Protection Law, Marine Environmental Protection Law, Water Pollution Prevention and Control Law, Environmental Impact Assessment Law—the basic legal basis for ecological, environmental protection in fisheries waters 3. Regulations on Environmental Protection for Offshore Petroleum Exploration and Development, Regulations on Administration of Marine Dumping, Regulations on Prevention of Pollution and Damage to the Marine Environment by Pollutants from Land-based Sources, Regulations on Prevention of Pollution and Damage to the Marine Environment by Coastal Engineering Construction Projects, Regulations on Prevention of Pollution of the Environment by Shipbreaking, Regulations on Prevention of Pollution of the Marine Environment by Ships, Rules for the Implementation of the Water Pollution Prevention and Control Law—Protection and Management of Ecological Environment Involving Fisheries Waters 4. "Fisheries Water Quality Standards" (GB11607-89), "Regulations on the Method of Calculating Fishery Losses in Waters Pollution Accidents", "Regulations on the Procedures for Investigating and Handling Pollution Accidents in Fisheries Waters", "Measures for the Administration of Qualifications for Investigating and Identifying Fisheries Pollution Accidents", "Code of Practice for Reporting Information on Pollution Accidents in Fisheries Waters and Emergency Handling"—Fisheries Waters Specific Bases for Handling Pollution Accidents 5. Regulations and normative documents related to marine environmental management, such as marine special protected areas, also address environmental protection and management of fisheries waters
6. Regulations on the conservation and management of aquatic wildlife	1. Fisheries Act: only basic principle provisions (Art. 37) 2. The Environmental Protection Act, the Marine Environmental Protection Act, also contains provisions in principle 3. Wildlife Protection Law, List of State Key Wildlife Protection, Regulations on the Import and Export Management of Endangered Wild Animals and Plants, Regulations on Nature Reserves—Basic Comprehensive Legal Basis 4. Implementing Regulations on Aquatic Wildlife Protection "Aquatic Wildlife Utilization Concession Scheme"—the direct basis for aquatic wildlife protection and management 5. A series of other relevant departmental regulations and normative documents relating to aquatic wildlife nature reserves, resource protection fees, import and export, operation and utilization, etc.
7. Laws and regulations on the supervision of fishing ports and management of fishing vessels	1. Fisheries Act: basic principle provisions (Art. 27) 2. Regulations on Traffic Safety Management in Fishing Port Waters 3. Maritime Traffic Safety Act—the basic legal basis for the supervision of coastal fishing ports and the management of fishing vessels 4. Radio Administration Regulations, Regulations on the Administration of Waterways, Regulations on Navigational Beacons, Regulations on the Administration of Safety in Inland Waterway Traffic, Regulations on the Investigation and Handling of Marine Traffic Accidents, Regulations on Ship Registration—Important Administrative Regulations on the Supervision of Fishing Ports and Management of Fishing Vessels 5. Regulations and normative documents: many aspects of fishing vessel water traffic management, fishing port management, fishing vessel registration, fishing vessel crew examination and licensing, reporting to and from fishing ports, fishing beacons, fisheries radio, fisheries safety communication networks, fishing vessel water accidents and search and rescue at sea, prevention of pollution from fishing vessels, etc.

Table 1. *Cont.*

8. Legislation on the administrative supervision and management of fisheries	1. Relevant provisions of the Fisheries Act and the Regulations for the Implementation of the Fisheries Act 2. Administrative Punishment Law, Administrative Compulsory Law, Administrative Permit Law, Administrative Procedure Law, Administrative Reconsideration Law, State Compensation Law, Administrative Supervision Law, Civil Service Law—Basic Administrative Law System 3. Provisions on Procedures for Administrative Penalties in Agriculture, Provisions on Administrative Penalties in Fisheries, Provisions on Hearing Procedures for Administrative Permits in Agriculture, Provisions on Administrative Penalties for Supervision of Fisheries Ports and Navigation, and Specifications for the Production of Agricultural Administrative Law Enforcement Instruments—Administrative Penalties and Permits in Fisheries. 4. Other departmental regulations and normative documents relating to fisheries law enforcement documents, law enforcement uniforms, fisheries administrative law enforcement vessels, and the fisheries management command system.
9. Regulations on the market and distribution of fish products	1. Measures for the Management of Wholesale Aquatic Products Markets 2. Relevant regulations and normative documents: Measures for the Management of Chinese Famous Brand Agricultural Products, Interim Measures for the Management of Information Collection in Wholesale Aquatic Products Markets of the Ministry of Agriculture, Measures for the Management of Designated Markets of the Ministry of Agriculture, etc.
10. Domestic legislation on foreign-related fisheries management	1. Basic provisions of the Fisheries Act (Arts. 8, 23, 46) 2. Law on the Territorial Sea and Contiguous Zone, Law on the Exclusive Economic Zone and Continental Shelf, Declaration on the Baselines of the Territorial Sea, Regulations on the Management of Foreign-related Marine Scientific Research—Basic Legal Basis for Foreign-related Fisheries Management 3. Interim Provisions on the Administration of Fishing Activities by Foreigners and Foreign Vessels in Waters under the Jurisdiction of the People's Republic of China, Interim Measures on the Administration of Waters under Provisional Measures of the China-Japan Fisheries Agreement, Measures on the Administration of Waters under Provisional Measures of the China-Korea Fisheries Agreement and Transitional Waters, Regulations on the Administration of Offshore Fisheries, etc. 4. Other specific matters: regulations and normative documents relating to the prohibition of the use of large-scale drift gilet operations on the high seas, management of self-caught fishery products in offshore fisheries, tax exemptions for offshore fisheries, safety production in offshore fisheries, monitoring of vessel positions in offshore fisheries, fishing logbooks in offshore fisheries, management of crew members in offshore fisheries, as well as surrounding waters and Antarctic fisheries.
11. Other relevant domestic legislation	1. The provisions of the Criminal Code relating to the crime of illegal fishing of aquatic products and the crime of illegal hunting and killing of precious and endangered wild animals, and the crime of illegal acquisition, transport, and sale of precious and endangered wild animals and precious and endangered wild animal products. 2. "Provisions of the Supreme People's Procuratorate and the Ministry of Public Security on the Criteria for Filing and Pursuing Criminal Cases under the Jurisdiction of Public Security Organs (I)" "Provisions of the Supreme People's Court on Several Issues Concerning the Trial of Cases Related to Sea Areas under Our Jurisdiction (I) (II) 3. Regulations and normative documents such as the "Emergency Circular of the General Office of the Ministry of Agriculture on Strengthening the Safety of Fishing Vessel Production", "Regulations on Fisheries Statistics", and "Provisional Measures for the Assessment of Fisheries Statistics The Law on Quarantine of Animals and Plants in and out of the Country, the Law on Agriculture, the Law on Agricultural Technology Extension, the Law on Work Safety, and other laws relating to fisheries 4. Local rules, regulations, and other legal documents on fisheries.

Table 1. *Cont.*

12. International treaties concluded and to which our country is a party	1. Multilateral treaties. Relevant treaties on the use, conservation, and management of biological resources, such as the United Nations Convention on the Law of the Sea, the Convention on International Trade in Endangered Species of Fauna and Flora, and the Convention on Biological Diversity. Global/regional treaties on international fisheries, international fisheries treaties on single living resource species. International treaties on the safety of fishing vessels at sea on the management of fishing vessels, and the prevention of pollution from fishing vessels, such as the International Convention for the Safety of Life at Sea, the International Regulations for Preventing Collisions at Sea, and the International Convention for the Safety of Life at Sea. 2. Bilateral agreements. Bilateral agreements on marine fisheries are signed by the country with neighboring countries. Bilateral agreements on border rivers and lakes are signed by the country with neighboring countries. The fisheries cooperation agreements that we have signed with non-neighboring countries are based on our entry into the waters under the jurisdiction of other countries to conduct offshore fisheries.

3.1. Classification in Terms of the Hierarchy of Legal Effects

The sources of fisheries laws and regulations are mainly the relevant provisions in the Constitution, fisheries laws, fisheries administrative regulations, fisheries local regulations, fisheries regulations, autonomous national regulations and unilateral regulations on fisheries, and other laws and regulations on fisheries or fisheries management to be observed, interpretation of fisheries laws, international fisheries treaties, etc.

Fisheries laws and regulations of different origins have different levels of validity based on the principle of constitutional supremacy: the relevant provisions in the Constitution are the highest level of validity [6].

According to the principle of order of equivalence: laws take precedence over administrative regulations, local regulations, and rules; administrative regulations take precedence over local regulations and rules; local regulations take precedence over local government regulations at their level and at lower levels; regulations made by the people's governments of provinces and autonomous regions take precedence over regulations made by the people's governments of larger municipalities within their administrative regions; departmental regulations have an equal effect among themselves and between departmental regulations and local government regulations, and are applied within their respective spheres of competence. They shall be applied within the scope of their respective authority [7]. Where autonomous regulations and single-issue regulations make modifications to laws, administrative regulations, and local regulations under the law, the provisions of the autonomous regulations and single-issue regulations shall apply in the autonomous region; where the regulations of the special economic zone make modifications to laws, administrative regulations and local regulations per authorization, the provisions of the regulations of the special economic zone shall apply in the special economic zone. The Administrative Procedure Law of the People's Republic of China provides that the courts shall hear administrative cases based on laws, administrative regulations, and local regulations. Local regulations apply to administrative cases occurring within the administrative region. Reference is made to the regulations of ministries and commissions of the State Council and local regulations [8]. The people's courts hear administrative cases in national autonomous areas based on the autonomous and single-issue regulations of such national autonomous areas. The Legislative Law provides that in the event of inconsistency between local regulations and departmental regulations on the same matter, the State Council shall put forward its opinion, and where the State Council considers that local regulations should be applied, it shall decide to apply the provisions of the local regulations in that locality; where it considers that departmental regulations should be applied, it shall refer the matter to the Standing Committee of the National People's Congress for a ruling. Where there is an inconsistency between departmental regulations or between departmental regulations and local government regulations on the same matter, the State Council shall rule on the

matter. Concerning the question of how to refer to regulations, the 1999 Interpretation of the Supreme People's Court on Several Issues Concerning the Implementation of the Administrative Litigation Law of the People's Republic of China stipulates that the people's courts hearing administrative cases may cite legally valid regulations and other normative documents in their adjudication documents. The court shall not apply any of the following cases: (1) Matters that do not fall within the competence of the administrative organ, and the administrative organ makes regulations. (2) Regulations that impose obligations on citizens but have no legal basis. (3) Regulations that are inconsistent with the corresponding contents of laws and administrative regulations. (4) Regulations that interpret, supplement, or concertize general provisions of laws or administrative regulations, the contents of which are contrary to the legislative intent or violate the principles of the socialist legal system.

According to the principle of the precedence of special laws: if the special provisions are inconsistent with the general provisions of laws, administrative regulations, local regulations, autonomous and unilateral regulations, and rules enacted by the same organ, the special provisions shall apply. The prerequisites for the precedence of special laws are that the special laws chosen are from the same source of validity or the same source of validity as the general laws and that they are in the same position of validity according to the principle of equal order of precedence, that their specific provisions are inconsistent or inconsistent, and that the provisions of the special laws do not contradict the spirit of the basic principles of the Constitution and the laws. However, it is important to note that national autonomous and unilateral regulations and special economic zone regulations may conditionally take precedence over administrative regulations or local regulations of the same level of validity or even over laws.

Following the principle of the precedence of the new law over the old one, when there is an inconsistency between a new general provision and an old special provision on the same matter between laws, it is impossible to determine how to apply them. When there is an inconsistency between a new general provision and an old special provision on the same matter between administrative regulations, and it is not possible to determine how to apply them, the State Council shall rule. In the event of inconsistency between a new general provision and an old special provision formulated by the same organ, the organ that formulated the provision shall rule.

Under the principle of the primacy of substantive law: procedural law may not be invoked in contradiction with substantive law [9].

According to the principle of the primacy of international law: a sovereign State may not refuse to comply with its international obligations under international law on the grounds of domestic legal norms; where a State's domestic legislation relates to international legal norms, an international treaty or international practice to which the sovereign State is a party or which it has accepted is also binding on domestic legal norms, which may not be inconsistent with that international treaty or international practice. The domestic legislation of a State is also binding on the domestic legal norms when it relates to international legal norms, which may not conflict with the international treaty or international practice.

3.2. Classification by the Content of Laws and Regulations

There are numerous laws, administrative regulations and departmental regulations in the system of fisheries laws and regulations, which can be roughly classified into 12 categories according to the contents of different laws and regulations: (1) basic fisheries laws; (2) laws and regulations on fishing production; (3) laws and regulations on the conservation and management of fisheries resources; (4) laws and regulations on aquaculture; (5) laws and regulations on ecological environmental protection and management of fisheries waters; (6) laws and regulations on protection and management of aquatic wildlife; (7) laws and regulations on the supervision of fishing ports and the management of fishing vessels; (8) legislation on the administrative supervision and management of fisheries; (9) regulations on the market and circulation of aquatic products; (10) domestic regulations

on foreign-related fisheries management; (11) other relevant domestic regulations; and (12) international treaties concluded by China and to which it is a party.

3.3. Annotation: Author Arrangement

China has a large number of fisheries laws and regulations and a complex system of laws and regulations that specifically address fisheries production activities, such as the Fisheries Law, the Rules for the Implementation of the Fisheries Law, and the Regulations on the Administration of Aquaculture Quality and Safety. Another part is the specific provisions related to the legal relations regulating fishery production activities, such as the provisions of the Criminal Law on the crime of illegal fishing of aquatic products. According to incomplete statistics, China has formulated and promulgated more than 600 national and local laws, regulations, and rules related to fisheries, forming a relatively complete system of fisheries laws and regulations, which basically meets the needs of China's fisheries development situation and also basically adapts to the development trend of international fisheries regulations. China has a large number of fishery laws and regulations with a complex system. There are laws and regulations specifically for fishery production activities, such as the Fisheries Law, the Rules for the Implementation of the Fisheries Law, and the Regulations on Aquaculture Quality and Safety Management. Another part is the specific provisions related to the legal relationship regulating fishery production activities, such as the provisions of the Criminal Law on the crime of illegal fishing of aquatic products. According to incomplete statistics, China has formulated and promulgated more than 600 national and local laws, regulations, and rules related to fisheries, forming a relatively complete system of fisheries laws and regulations, which basically meets the needs of the development situation of fisheries in China and also basically adapts to the development trend of international fisheries regulations." The above-mentioned laws and regulations regulate certain aspects of fisheries and, in general, are divided into several parts. Domestic laws and regulations are biased toward conservation, exploitation, etc. In contrast, international law and related laws and regulations have prominent contributions in areas such as law enforcement and dispute resolution between countries. Overall, this part of the treatise is a summation of the statutes concerning fisheries, revealing the evolution of China's fisheries legislation and enforcement during this historical period and serving as an important pavement for the resolution of fisheries issues in the next step [10].

4. Coming to Grips: The Development of China's Fisheries Legal System

With the current rapid economic and social development and the ongoing structural reform on the supply side of the fisheries industry, China's fisheries legal system has been effectively implemented to a certain extent in various sectors, but many problems still exist.

4.1. Weak Protection of Production Rights and Interests in the Legal System of Farming and Dilution of the Concept of Green and Ecological Development

China's aquaculture waters have been reasonably planned and utilized. Aquaculture permits have been issued to those who meet the conditions following the law, but the development and utilization of mudflats in aquaculture waters are currently encountering many difficulties [11]. For example, the area of aquaculture in China has been decreasing yearly since 2015, with a total reduction of 1.28 million hectares to date, including the shrinkage of 1 million hectares of freshwater aquaculture. The Fisheries Law stipulates that the expropriation of collectively owned waters and mudflats is handled under the provisions of the Land Management Law on land expropriation, and the lack of clear compensation standards for expropriation has led to inconsistent standards across the country. In the mariculture area, with the rapid development of sea use by port industries and traffic channels, the scope of farming waters is shrinking and being finely divided. More fishermen are losing their sea and competing for sea [12]. In addition, the unstable implementation of planning measures for aquaculture waters and beaches, the unclear

policy on the use of maritime areas for aquaculture purposes, and the lack of detailed regulations on the right to use waters and beaches in higher-ranking laws have greatly weakened the protection of the rights and interests of aquaculture producers.

The current legal system for aquaculture still lacks institutional arrangements that are compatible with deepening the structural reform of the supply side of fisheries and enhancing the supply of high-quality, green, and safe aquatic products. For one, the provisions for preventing and controlling aquatic organisms and disease prevention and control need to be strengthened. The economic loss of China's fisheries due to diseases in 2018 was 2.61 billion yuan, with 205,000 tons of production loss and 15.3 hectares of the affected area; two, there is insufficient scientific and technological support for fisheries, the development of the aquatic seed industry is lagging, and the legal provisions for the preservation of original seeds, the research and development of good seeds, and the transportation, sale, and introduction of aquatic seeds in different places need to be improved; for three, The system of production records for farmers is not sound, the approval system for the introduction of species from outside the country by farmers is not sound. There is a lack of sufficient green ecological risk assessment, which is not conducive to the sustainable development of the aquaculture industry.

4.2. Lack of Responsibility for Ecological and Environmental Protection of Water Areas and Fragile Basis for Conservation of Fishery Resources

The main legal provisions for ecological and environmental protection of waters are Articles 20 and 36 of the Fisheries Law and related supporting regulations. According to the data of the Report, in 2018, the main exceed indicator in China's marine fishery waters was inorganic nitrogen, and the main exceed indicator in inland waters was total nitrogen; 140 fishery pollution accidents were reported nationwide, and the economic loss of fishery caused by pollution was RMB 820 million [13]. In the marine fishery industry, pollution in waters mainly stems from problems such as unsupported near-shore sewage pipeline networks, a low proportion of sewage treatment, and excessive direct discharge; in inland aquaculture, pollution in waters mainly stems from problems such as unsound long-term mechanisms for pollution control, incomplete compensation mechanisms, and unclear responsibilities for ecological restoration. All these require further implementation of the legal responsibility for ecological and environmental protection of waters and clarification of the responsible parties.

In addition, river planning and development and the construction of large-scale water conservancy projects harm the ecological environment of the waters and the conservation of fishery resources. The provisions of Articles 32 to 35 of the Fisheries Law on reducing the impact of engineering construction on fishery resources have not been strictly enforced. Although our regulations on closed areas, closed periods, and fishing gear management have had a positive effect on the conservation of fishery resources, there is still a gradual decline in many fish species. As one of the important ways to conserve fishery resources, marine ranching has attracted much attention, but since it involves the use of sea areas, construction of sea-related projects, ecological breeding, and resource enhancement, the relationship between the body of inputs and the responsibilities and powers of government departments still needs to be further clarified.

4.3. The Fishing Management System Is Not Effectively Implemented, and Legal Liability Is Not Yet Clear

Problems with the fishing management system are among the important issues of concern in the development of China's fisheries legal system. First, the fishing limit system is stipulated in Articles 22 and 23 of the Fisheries Law and its related supporting system. Still, it has been implemented only on a pilot basis in specific areas, at specific times, and for specific species and has not been fully implemented. Second, there are serious problems with fishing licenses. For example, the procedure for issuing fishing permits is not strict, the conditions for issuing fishing permits are not realistic, and the legal liability for fishing without a fishing permit is not clear. In particular, there is no provision for the punishment

of fishing-related "three noes" vessels, and there is no legal basis for the supervision of fishing-related "three noes" vessels. Thirdly, the safety supervision of fishing vessels is not effective [14]. The basic information about fishing vessels lacks modern means of intercommunication and exchange, and there are many illegal fishing vessels with fake and swapped names and numbers. The inspection of fishing vessels' safety production facilities lacks regulation, and the safety responsibility system of vessel owners is not fully implemented. For example, a major incident involving the fishing vessel "Qinghai Fishing 01039" of Hainan Province in July 2019 in the Aisha Sea revealed serious problems in terms of illegal overcrowding, incomplete crew, low certification rate of ordinary crew members, and failure to form up according to reports.

4.4. The Status and Responsibilities of Law Enforcement Subjects Need to Be Clarified, and Law Enforcement Capacity Needs to Be Improved

At present, China has a total of 2679 fishery law enforcement agencies, 2581 fishery vessels of various types, and 27,400 licensed law enforcement officers [15]. However, the fisheries laws and regulations clearly define the status of fisheries departments at all levels as the main law enforcement agencies and their supervisory responsibilities, and the supervisory responsibilities of relevant government departments are not yet clearly defined; the joint law enforcement of fisheries, marine police, public security, transportation, environmental protection, market supervision, and other departments at all levels needs to be strengthened. The efficiency of law enforcement needs to be improved, as does the ability to enforce the law.

In the new round of institutional reform, the institutional setting of fisheries supervision and enforcement needs to be further rationalized, but what needs to be addressed more is the scale and pace of law enforcement. In the implementation of legal responsibilities for fisheries violations, there are problems such as lenient responsibilities and penalties, vague definitions of degrees, poor connection between execution and punishment, single means of punishment, and the cost of violating the law is too low compared with high profits, making it difficult to form an effective legal deterrent, etc. There are also problems such as insufficient authorization for administrative enforcement of fisheries law, lack of penetrability of some punitive measures, and lack of corresponding penal provisions for some prohibitions. In short, a nationwide "one-stop" regulatory mechanism has not yet been established.

4.5. Policies for the Development of Fishing Areas Are Still Inadequate, and the Management System for Foreign-Related Fisheries Still Needs to Be Improved

China still has 7965 fishing villages and an 18.78 million fishing population, including 6.18 million traditional fishermen, and the growth of finishers' income in 2018 was lower than that of rural residents [16]. There are insufficient focus points to achieve the comprehensive revitalization of fishing villages, and the economic structure of fishing areas is relatively homogeneous. The infrastructure construction of traditional fishing villages cannot keep up, and the public service system needs to be improved, especially with the increase in the fishing ban and resource conservation. The pressure on fishermen to re-employ and sustain income is greater, and fishermen have no land, lack production skills, and the protection of rights and interests cannot be implemented.

Supportive policies and measures have not been fully implemented in foreign-related fisheries, and there are problems with the management of labor in offshore fishing enterprises, difficulties in the entry and exit of foreign crew members, and less support for the construction of overseas bases. Foreign fishing vessels illegally cross the border, domestic fishing vessels operate in violation of fisheries agreements, and normal operations are also disturbed. Cases of foreign fishing infringement occur from time to time. The management system for foreign-related fisheries still needs to be improved.

In summary, with the continuous development of the fisheries economy, the problems revealed by China's fisheries legal system in the above aspects have aroused widespread

concern in society, and the process of amending the Fisheries Law and its related supporting provisions has been actively promoted with good prospects for development.

5. Outlook: Prospects for the Development of China's Fisheries Legal System

5.1. Strengthen the Protection of the Rights and Interests of Farming Production and Focus on Green and Ecological Development of Farming

Article 123 of the Property Law stipulates that "the rights to prospect, mine, take water and use waters and beaches for farming and fishing acquired following the law shall be protected by law" [17]. This is the first time that the basic civil law of the country has regulated the issue of fishing rights, and it is also the basis for the amendment of the Fisheries Law. On this basis, the legal provisions of Articles 11, 14, and 15 of the Fisheries Law on the planning and use of farming waters and shoals, expropriation management, and protection of key farming waters should be implemented to protect the legitimate rights and interests of fishery producers following the law. First, the rights of collectively owned waters and beaches should be confirmed, and farming licenses should be issued under the law; second, the boundaries of farming waters and beaches should be clarified, and disputes over boundary delimitation and crossing should be avoided at the source; third, the planning of farming waters and beaches should be reasonably formulated, and incorporated into the unified spatial planning of the country following the requirements of the "unification of multiple regulations"; fourth, the use fees for farming waters and beaches should be appropriately reduced or even exempted according to the actual situation, effectively reducing the burden of fishermen and protecting their rights and interests [18]. As early as 2015, Chaos Faze, a member of the National Committee of the Chinese People's Political Consultative Conference and an academician of the Chinese Academy of Engineering, submitted a proposal on exempting the use of sea areas for fisheries, hoping to exempt fishermen from the use of sea areas, and hoping that this measure to protect the rights and interests of fishermen will be put into practice as soon as possible.

In promoting the development of green and ecological aquaculture, first, implement legal provisions on quarantine of aquatic seeds and disease prevention and control, and step up supervision to avoid disease losses; second, legislate to encourage the use of high science and technology, cultivate new species of aquaculture, and develop and promote green aquaculture models; third, strictly control the transportation, sale, and introduction of aquatic seeds, clarify the division of responsibilities and strengthen all-round quality supervision; fourth, improve aquatic product trade policies, promote factory-scale aquaculture, and innovate integrated promotion models to promote the benign and sustainable development of aquaculture.

5.2. Maintaining the Ecological Environment of the Waters and Strengthening the Basis for the Conservation of Fishery Resources

Concerning the restoration and maintenance of the ecological environment of waters, the main responsibility of farming producers must first be clarified [19]. Raise the awareness of the responsibility of farming producers to maintain the ecological environment of farming areas through the management of water discharges from farming areas and the centralized collection and disposal of farming by-products and waste. Secondly, the government's responsibility for protection should be clarified. Both coastal and inland regions need to establish a system of fixed pollution source regulation with discharge permits as the core and promote integrated management of the ecological environment on land and sea in a coordinated manner. At the same time, the linkage of various government departments should be brought into play to coordinate the promotion of watershed protection. Once again, it is necessary to promote the convergence of the Fisheries Law with the Water Pollution Prevention and Control Law and the Marine Environmental Protection Law, refine the standards for the environmental protection of waters, and improve and perfect the institutional measures for the ecological protection of fisheries.

Concerning the conservation of fishery resources, we must actively promote the sustainable use of fishery resources. First, the fishing quota system should be reasonably

determined through dynamic monitoring and analysis. Second, according to the status of fishery resources and the law of fish reproduction and growth, we should scientifically establish closed seasons and closed areas, regulate the management of fishing moratoriums and ambush periods, and provide appropriate subsidies to fishermen. Third, promote the construction of marine pastures reasonably. On 6 March 2019, Mo Angolan, a deputy to the National People's Congress and a researcher at the Yellow Sea Fisheries Research Institute of the Chinese Academy of Fisheries Sciences, spoke at a plenary session held by the Shandong delegation at the second session of the 13th National People's Congress, saying that it is necessary to play the role of scientific and technological support to overcome various bottlenecks in the development of the industry in a new way of modern aquaculture, especially on the construction of marine pastures put forward three proposals. "First, the importance of strengthening the key and common technology research on marine ranching; second, the construction of marine ranching information technology comprehensive security system; third, the establishment of a multifunctional service platform for marine ranching that integrates the functions of detection, scientific research, management and care, replenishment, tourism, etc., to create a modern marine ranch that gives full play to ecological and environmental protection, biological resources conservation, fishery enrichment, recreational fishing, etc." [20]. Fourth, to promote the close connection between administrative law enforcement and criminal justice, simplify the inspection and identification procedures of public security organs, and promote public interest litigation as a means of fishery resource protection.

5.3. Improving the Level of Fishing Regulation and Clarifying Legal Responsibilities

The initiatives to reasonably determine fishing limits and strictly approve the issuance of fishing licenses, which have been mentioned earlier, are regulatory management of fishing. However, the comprehensive enhancement of fishing regulation is also a safeguard for regulated fishing. On the one hand, we should increase the supervision of fishing ports. According to the distribution of fishing ports, the distribution of supervision forces and the unloading habits of the catch, etc., determine the designated fishing ports for anchoring fishing vessels and landing the catch, and establish a system for declaring landing and traceability management [21]. At the same time, the entry and exit of fishing vessels from and to ports should be regulated, and the inspection system of fishing vessels should be standardized. On the other hand, it is necessary to increase the supervision of fishing-related "three-no" vessels. It is necessary to clarify in the law the criteria for identifying fishing-related "three-nothing" vessels and the legal responsibilities of their owners and to give the fisheries supervision and law enforcement departments the necessary means of administrative enforcement and administrative penalties for cleaning up and banning fishing-related "three-nothing" vessels.

5.4. Increase Fisheries Enforcement Efforts and Train a High-Quality Enforcement Team

China's fisheries supervision and management are under unified leadership and hierarchical management. With the deepening of institutional reform, departmental responsibilities have changed, and the concept of comprehensive management has taken root, with departments such as fisheries administration, fishing ports, marine police, transportation, environmental protection, resources, and markets collaborating in their regulatory functions, to ensure full coverage and no blind spots in fisheries law enforcement. In marine waters, joint regional law enforcement is encouraged; inland waters, joint cross-provincial watershed supervision are encouraged [22]. At the same time, training for fisheries law enforcement officers is conducted regularly and irregularly to improve their theoretical knowledge and enforcement level. Finally, efforts should be made to ensure the use of modern law enforcement facilities and equipment. The fisheries law enforcement departments should be given the necessary administrative coercive means to seize, detain, confiscate fishing vessels and gear, board and inspect, and suspend flights for investigation. The circumstances under which they can take administrative coercive measures should be clarified.

The increase in fisheries enforcement will greatly facilitate the effective implementation of fisheries laws.

5.5. Improving Supporting Policies for Fishing Areas and Achieving International Convergence in the Management of Foreign-Related Fisheries

To promote the comprehensive and coordinated development of fishing areas, explore the implementation of the PPP model (Public-Private Partnership) for the construction of fishing ports, and improve relevant supporting policies to guide the flow of social funds to the construction and management of operational services such as fishing port supplies, ship maintenance, aquatic processing, and product trading, and properly improve the management norms for leisure fisheries, to drive the development of fishing areas and fishing villages through fishing ports. PPP (Public-Private Partnership), or the government-social capital cooperation model, is a project operation model in the field of public infrastructure. Under this model, private enterprises and private capital are encouraged to cooperate with the government and participate in the construction of public infrastructure. According to this broad concept, PPP refers to the process of cooperation between the government public sector and the private sector in which non-public sector resources are involved in the provision of public goods and services, thereby enabling the cooperating parties to achieve more favorable results than would be expected if they acted alone [23].

Concerning the management of foreign fisheries, we must first encourage and support the development of China's offshore fisheries. In line with China's "One Belt, One Road" and "Strong Ocean State" initiatives, we will reasonably promote the development of offshore fisheries. Tariff reductions and exemptions should be granted for introducing high-quality aquatic products in short supply in the domestic market. The coordinated development of the entire industrial chain of capture, processing, and distribution of offshore fisheries should be fostered. Secondly, we should actively participate in the development and utilization of international fisheries resources, effectively safeguard the rights and interests of national marine fisheries, actively participate in the formulation of bilateral and multilateral fisheries treaties, agreements and standards, and norms, and expand the space for the development of China's offshore fisheries, while at the same time dealing with illegal cross-border fishing in waters under our jurisdiction following the law. Finally, concerning the management and protection of foreign crew members, the proportion of foreign crew members should be determined, the rights and obligations of foreign crew members should be clarified, and the management of foreign crew members' entry and exit in domestic ports should be regulated. Support should be provided to facilitate the reduction of operating costs for Chinese offshore enterprises.

6. Conclusions

To sum up, with the continuous development of China's economy and politics, China's fisheries laws have gone through different historical periods and gradually moved towards perfection. The current fisheries legal system is relatively complete, but many problems remain. We will continue to regulate aquaculture and fisheries, restore the water environment, protect the sustainable development of fishery resources, strengthen law enforcement and supervision, effectively promote the construction of fishing areas, and protect the interests of fishermen. The move is also in line with China's "One Belt, One Road" and "maritime power" strategy, gradually aligning fisheries laws with international standards. The revision of the Fisheries Law has attracted much attention because it will greatly promote the high-quality development of China's fishery legal system and fishery, as well as the development of China's agricultural industry and economy and China's comprehensive national strength.

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Coordinated Development of the Marine Environment and the Marine Fishery Economy in China, 2011–2020

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Abstract: The marine environment is the material basis for the survival and development of fishery resources, and changes in the marine environment affect the fishery economy. Therefore, against the background of sustainability and environmental uncertainty, it is important to investigate the development of the marine environment and the marine fishery economy to improve the quality of both. Taking the panel data for 11 coastal cities in China from 2011 to 2020, we use several methods, including the entropy method, a coupling harmonious degree model, and a Tobit model, to measure the marine-environment quality and marine-fishery-economy quality, their coordination, and the factors affecting that coordination. We find that (1) the marine-environment quality and marine-fishery economy quality show a significant upward trend over time, but they are spatially unbalanced, with obvious interprovincial differences. (2) Coordination between the marine-environment quality and marine-fishery-economy quality has risen steadily, but the level of coordination is still low, remaining at the primary level in most areas. (3) The important factors affecting coordination between the marine-environment quality and marine-fishery-economy quality include the strength of the marine fishery industry, scale of the marine fishery economy, production capacity of marine fisheries, marine-environment quality, and quality of the marine environment and its resources. In light of these findings, we should increase the coordination between the marine-environment quality and marine-fishery-economy quality by upgrading the marine fishery industry, modernizing marine fisheries, linking the environmental governance of marine and land areas, and strengthening the ecological construction of the marine environment.

Keywords: fishery economy; marine environment; coupling coordination; high-quality development; marine economic circle

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1. Introduction

The marine environment is an important source and guarantee for the development of the marine fishery economy. However, with the ongoing expansion of human activity into the marine space, the marine fishery economy and the marine environment face a dilemma of mutual restriction and impact. The extensive development of traditional marine fisheries and marine overfishing have resulted in the extinction of many species and the increasing vulnerability of marine ecosystems. According to the FAO report on the State of World Fisheries and Aquaculture in 2017, the proportion of fish stocks caught within the sustainable limit showed a downward trend, from 90.0% in 1974 to 66.9% in 2015. The proportion of fish stocks caught at unsustainable levels increased from 10% to 33.1% over the same period [1]. The discharge of pollutants from aquaculture and marine fishery has harmed and seriously polluted the marine environment, leading to the oxidation of marine resources, frequent marine disasters, the pollution of coastal environments, marine ecosystem degradation, and the spread of marine garbage. Meanwhile, changes in the

marine climate, storm surges, coastal erosion, rising sea levels, seawater warming, and acidification have harmed marine fisheries, restricting the development of marine fishery economies. In 2019, researchers found that from 1930 to 2010, the total output of global fishing grounds decreased by 4.1% owing to the effects of climate change [2]. According to the latest FAO's State of World Fisheries and Aquaculture in 2022, the sustainability of marine fishery resources is still a matter of deep concern. In 2019, the proportion of sustainable catch stocks will decline to 64.6%, 1.2% lower than the level in 2017 [3].

Promoting the sustainable development of the marine fishery economy and improving marine-environment quality have, therefore, attracted considerable attention. In a 2022 report, the Intergovernmental Panel on Climate Change noted that climate change has a great impact on humans and ecosystems and that it spreads across regions through interconnected systems [4]. The practice of global environmental governance has confirmed that the development mode of "pollution first, then treatment, and pollution during treatment" is unsustainable. With increasing risks from external uncertainty and the intensifying climate crisis, focusing only on the development of the marine fishery economy is likely to exacerbate marine-environment deterioration and ultimately hinder development. Likewise, focusing only on marine environmental protection will hamper the development of the marine fishery economy. Therefore, promoting benign interaction between the two is important for the economic development of coastal nations. The development of the marine environment and the marine fishery economy does not have to be a contradictory zero-sum game; rather, it can reflect a mutually beneficial coexistence. On the one hand, the marine environment provides the resource carrying capacity and development space for the marine fishery economy. On the other hand, the marine fishery economy provides support for marine environmental protection and governance. Protecting the marine environment can, therefore, promote the sustainable development of the marine fishery economy, as opposed to harming it. Thus, studying the coordination between marine-environment quality and marine-fishery-economy quality has important theoretical and practical significance for improving the marine fishery economic structure, optimizing the allocation of marine fishery resources, enhancing the functions of the marine environment, and improving the marine-environment quality.

A growing body of related literature has emerged in recent years, focusing on issues of the sustainable development of the fishery economy, fishery economic efficiency, common fishery policy, and regional fishery governance [5–7]. Globally, marine fisheries play crucial economic, social, and cultural roles; they support human well-being through employment in fishing, processing, and retail services [8], as well as food security [9]. Fisheries are prone to uncertainty because environmental, institutional, economic, and social changes are not easily foreseen or determined [10]. Gordon noted that unless controls are placed on fishing, fisheries are susceptible to problems associated with open-access arrangements, such as over-exploitation and over-capitalization [11]. Hartmann et al. investigated the economic optimality of implementing Marine Protected Areas (MPAs) to obtain more informative data about fish populations, thereby allowing for better management strategies [12]. Sun et al. examined the specific manifestations of the sustainable utilization of marine fishery resources from the perspectives of time and space [13]. Unregulated fishing practices result in the overexploitation of resources, both in biological and economic terms. Fishery resources comprise five different groups with different problems and issues: small pelagics, large pelagics, demersal fish, bivalves (e.g., mussels, oysters, and clams), and others (e.g., sponges, coral, and algae) [14]. Lauria noted that fish consumption varies from country to country depending on the local traditions and the supply of fish. For example, fish is a key component of people's diets in many developing countries because it is often the only affordable and readily available source of animal protein [15]. Building on Gordon's insights, Smith developed a predictive theory of how the dynamics of open-access fishery will unfold [16]. Recent research on fishery economics has examined incentives across many margins, including the within-season effects, incentives to harvest different ages and sizes of fish, responses to ecological disturbances, spatial choices, and multispecies interac-

tions [17]. Interestingly, research has revealed the factors affecting marine environments, including the overexploitation of fishery resources, coastal pollution, fishing's effect on marine ecosystems, marine ecosystem management, and protected marine areas [18–21]. Fishing intensification and its related environmental effects have led to a massive reduction in targeted species as well as the extinction, through indirect ecological effects, of other species in the marine food web; however, the effect of fishing practices on other species and habitats is still poorly understood and is likely to remain so for some time [22]. Research on marine-environment protection is mainly based on the effect of the environment on the marine economy [23], focusing on the relationship between balancing economic growth and ecological restoration according to the local conditions. Previous research on the coordination between the marine environment and the marine economy has constructed systems for sustainable economic and environmental development, analyzed their operational mechanisms and levels of coordinated development, evaluated their degree of coordination, and proposed measures for coordinated development [24–28].

In contrast to the abovementioned research, few studies have considered the relationship between the marine environment and the fishery economy. Although a general framework for monitoring and assessing the fishery economy and the marine environment has been developed, only a few empirical studies have been conducted [29–35]. In short, although there is substantial research on the marine fishery economy and the marine environment, most studies examine the two independently, without considering their coordinated development characteristics, spatial patterns, and related influencing factors. This study, therefore, takes 11 coastal provinces/cities in China as the research object, analyzes the spatio-temporal evolution of the coordination between the marine environment and the marine fishery economy, reveals the characteristics of such coordination, and identifies the factors affecting that coordination. This can enrich the research on the development quality of marine environments and marine fishery economies, provide a theoretical framework and path choice for improving coordination between the two, and provide a reference for formulating related policies.

2. Study Design and Methods

2.1. Study Area

We selected 11 major coastal provinces/cities in China as the research object (Hong Kong, Macau, and Taiwan were excluded): Liaoning, Tianjin, Hebei, Shandong, Jiangsu, Shanghai, Zhejiang, Fujian, Guangdong, Guangxi, and Hainan. We acquired data related to their marine environments and fishery economies and investigated the internal coordination relationships. The study period was 2011–2020. The data sources included the *China Fisheries Statistical Yearbook* (2011–2020), *China Statistical Yearbook* (2011–2020), *China Environmental Statistical Yearbook* (2011–2020), *Bulletin on the State of China's Marine Ecological Environment* (2011–2020), and a number of research articles published in professional journals. Missing data were obtained by linear interpolation or calculated by the authors.

2.2. Index Selection

We carefully selected quality indicators related to marine fishery economies and environments to evaluate the coordination between the two. The strength of the marine fishery industry (SFI), the scale of the marine fishery economy (SFE), and the capacity of marine fishery production (SFP) are important indicators for measuring the quality of the marine fishery economy; therefore, we selected those three as the primary indicators for measuring the quality of the marine fishery economy. Five secondary indicators were selected under each primary indicator, resulting in a total of 15 indicators for evaluating the fishery economic quality. Referring to the literature, the strength of the marine fishery industry is measured by the proportion of marine fishery in the fishery economy, the output value of that marine fishery, the output value of mariculture, the output value of marine fishing, and the per capita income of marine fishermen. The economic scale of marine fishery is measured by the output of marine products, marine aquaculture, output value

of pelagic fishery, marine fishing output, and mariculture area. The production capacity of the marine fishery is measured by the number of motorized marine fishing vessels, number of marine production fishing vessels, ownership of marine fishing vessels, number of fishery practitioners, and processing capacity of marine products. The index system for evaluating the marine-environment quality was mainly constructed in the two dimensions of marine resource environment quality (SCQ) and marine ecological environment quality (SBQ). Five indicators were selected for each dimension, for a total of 10 measurement indicators. The marine resource environment quality was measured by the direct economic loss from marine disasters, relative annual variation in the sea level, proportion of nearshore Class I and II water quality, coastal wetland areas, and nearshore and coastal areas. The marine ecological environment quality was measured by the direct discharge of marine wastewater, chemical oxygen demand, petroleum, ammonia nitrogen, and total phosphorus. These indicators reflect the marine ecological pollution and have a negative effect on the quality of the marine ecological environment as negative indicators. The entropy method was used for the evaluation, and the weighted scores were used to calculate the scores for the marine-environment quality and marine-fishery-economy quality in the research areas (Table 1).

Table 1. Evaluation index system of marine-environment quality and marine-fishery-economy quality.

Target Layer	Rule Layer	Weight	Index Layer	Index (Positive/Negative)	Weight
Quality of the marine fishery economy	Marine Fishery industry strength (SFI)	0.2440	Proportion of marine fishery in fishery economy (%)	positive	0.0299
			Marine fishery output value (CNY 10,000)	positive	0.0593
			Output value of mariculture (CNY 10,000)	positive	0.0730
			Marine fishing output value (CNY 10,000)	positive	0.0560
			Per capita income of fishermen (CNY)	positive	0.0258
	Marine Fishery economy scale (SFE)	0.4043	Seafood output (10,000 tons)	positive	0.0605
			Mariculture yield (10,000 tons)	positive	0.0780
			Pelagic fishery output (10,000 tons)	positive	0.1028
			Marine fishing yield (10,000 tons)	positive	0.0636
			Marine aquaculture area (hectares)	positive	0.0994
	Marine Fishery production capacity (SFP)	0.3517	Ownership of marine mobile fishing vessels (total tons)	positive	0.0695
			Ownership of marine production fishing vessels (tons)	positive	0.0631
			Number of marine mobile fishing vessels (units)	positive	0.0557
			Fishery practitioners (persons)	positive	0.0604
			Total processing amount of seawater products (tons)	positive	0.1030

Table 1. *Cont.*

Target Layer	Rule Layer	Weight	Index Layer	Index (Positive/Negative)	Weight
Marine-environment quality	Marine	0.7853	Direct economic loss from marine disasters (CNY 100 million)	negative	0.0281
	Resource		Relative annual variation in sea level (millimeters)	negative	0.0970
	Environment		Proportion of nearshore Class I and II water quality (%)	positive	0.1394
	quality		Coastal wetland area (10,000 hectares)	positive	0.2916
	(SCQ)		Nearshore and coastal area (square kilometers)	positive	0.2292
	Marine-Ecological Environment quality (SBQ)	0.2147	Direct discharge of marine wastewater (100 million tons)	negative	0.0403
			Chemical oxygen demand (tons/year)	negative	0.0620
			Petroleum (tons/year)	negative	0.0286
			Ammonia nitrogen (tons/year)	negative	0.0282
			Total phosphorus (tons/year)	negative	0.0556

Note: Weights are calculated according to the research methods of the entropy method.

2.3. Research Methods

2.3.1. Data Standardization

To eliminate the influence of the dimensions and the positive and negative directions of the index data on the results, we used the range method to standardize the data. The details are given below.

The processing method for the larger and better positive indicators is:

$$A_{ij}^{+} = (x_{ij} - x_{min})/(x_{max} - x_{min}) \quad (1)$$

For the smaller and better negative positive index, the processing method is:

$$A_{ij}^{-} = (x_{max} - x_{ij})/(x_{max} - x_{min}) \quad (2)$$

In the model, A_{ij} represents the standardized data matrix, $i (i = 1, \ldots, n)$ represents the province/city, $j (j = 1, \ldots, n)$ represents the index, x_{ij} is the original data matrix, and x_{max} and x_{min} represent the maximum and minimum values of x_{ij}, respectively.

2.3.2. Entropy Method

To improve the objectivity and credibility of the index weights, we used the entropy method to calculate the index weights and comprehensive scores of the marine-environment quality and marine-fishery-economy quality. The specific calculation steps of the entropy method are as follows:

Calculation of the index entropy:

$$e_j = -k \sum_{i=1}^{n} p_{ij} \ln(p_{ij}) \quad (3)$$

In the model $p_{ij} = A_{ij} / \sum_{i=1}^{n} A_{ij}$, e_j represents the index entropy ($0 \leq e_j \leq 1$), n represents the number of indexes, and $k = 1/\ln m$, $k > 0$, and m represents the number of evaluation objects.

Index weight determination:

$$w_j = (1 - e_{ij}) / \sum_{i=1}^{n} (1 - e_{ij}) \quad (4)$$

In the model, w_{ij} represents the index weight, e_{ij} represents the index entropy, and $w_j^{'}$=$\sum_{i=1}^{m} w_j$ represents the rule layer weight.

Calculation of the comprehensive score:

$$S = \sum_{j=1}^{n} w_j A_{ij} \tag{5}$$

2.3.3. Coupling Harmonious Degree Model

The coupling coordination model is used to measure two or more systems in physics. We used this model to build a coordination measurement model for the marine-environment quality and marine-fishery-economy quality. The formula is as follows:

$$M_{ij}= \left[\frac{H_{ij} * K_{ij}}{\left(H_{ij} + \frac{K_{ij}}{2}\right)^2} \right]^{\frac{1}{2}} \tag{6}$$

where M_{ij} represents the coupling value, $M_{ij}\epsilon(0,1)$, H_{ij} indicates the economic quality of the marine fishery, and K_{ij} represents the marine-environment quality. To further measure the coordination between the marine-environment quality and marine-fishery-economy quality, the following model is established:

$$N_{ij}= \theta H_{ij}+\lambda K_{ij} \tag{7}$$

$$T_{ij}= \left(M_{ij} * N_{ij}\right)^{\frac{1}{2}} \tag{8}$$

where T_{ij} represents the comprehensive coordination index between the marine-environment quality and marine-fishery-economy quality of province j in year i, $T_{ij}\epsilon$ [0,1], θ represents the weight of the marine-fishery-economy quality, and λ is the weight of the marine-environment quality. Since the contributions of the two systems are the same, the values assigned to them are the same: $\theta = \lambda = 1/2$. The value of T_{ij} reflects the relationship between the two systems. The larger the value, the higher the coordination degree between the marine-environment quality and marine-fishery-economy quality. The converse is also true. To more intuitively reflect the coordination relationship between the two, we used existing classification methods to divide the coordination values of the two systems, as shown in Table 2.

Table 2. Evaluation standard of coordination grade.

Coordination Grade	RHC	Coordination Grade	RHC
$0 < D \leq 0.2$	Serious disorder	$0.4 < D \leq 0.6$	Primary coordination
$0.2 < D \leq 0.3$	Mild disorder	$0.6 < D \leq 0.8$	Intermediate coordination
$0.3 < D \leq 0.4$	Barely coordinated	$0.8 < D \leq 1$	Senior coordination

Note: RHC: rank of harmony coefficient.

2.3.4. Tobit Model

The coordination between the marine-environment quality and marine-fishery-economy quality is characterized by a random distribution, and the value is between 0 and 1. If the ordinary least-squares (OLS) method was used for a regression, it would be unable to obtain a consistency estimate and the conclusion would be biased; therefore, we used the maximum likelihood intercept regression model—that is, the Tobit model. The Tobit estimator was proposed by James Tobin in 1958 to analyze estimations with censored dependent variables. A fixed-effects Tobit model is not feasible because there is no sufficient statistic whereby the fixed effects are conditioned out of the likelihood [36]. The formula of the Tobit model is as follows:

$$Y = \begin{cases} a + \beta X_{ij} + u_i + e_{ij}, & Y > 0, \forall i, t \\ 0, & Y > 0, \forall i, t \end{cases} \tag{9}$$

where Y is the coordination value vector of the marine fishery and marine environment, X is the independent variable vector, a is the intercept item, β is the parameter vector, u is the random variable, and e is the residual.

3. Spatio-Temporal Evolution of Marine-Environment Quality and Fishery-Economy Quality

Based on the entropy method (Formulas (3)–(5)), we calculated the marine fishery economy level of the selected provinces/cities from 2011 to 2020. Table 3 and Figure 1 show the detailed results.

Table 3. Marine-fishery-economy quality index in China's coastal provinces/cities (2011–2020).

Province/City	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Mean Value
Liaoning	0.3673	0.4043	0.4385	0.4689	0.4613	0.4507	0.4053	0.3936	0.3859	0.3889	0.4165
Tianjin	0.0124	0.0181	0.0298	0.0364	0.0360	0.0354	0.0325	0.0331	0.0371	0.0299	0.0301
Hebei	0.0800	0.0909	0.0928	0.0980	0.0999	0.1126	0.1122	0.1185	0.1179	0.1255	0.1048
Shandong	0.5271	0.6059	0.6357	0.7072	0.7422	0.7574	0.7264	0.7266	0.6971	0.7022	0.6828
Jiangsu	0.1353	0.1452	0.1645	0.1675	0.1729	0.1717	0.1770	0.1925	0.1657	0.1929	0.1685
Shanghai	0.0379	0.0429	0.0465	0.0552	0.0573	0.0585	0.0661	0.0731	0.0821	0.0769	0.0596
Zhjiang	0.3947	0.4455	0.4664	0.5091	0.5233	0.4808	0.5160	0.5528	0.5378	0.5604	0.4987
Fujian	0.4069	0.4549	0.4848	0.5083	0.5397	0.5651	0.5855	0.6217	0.6407	0.6541	0.5462
Guangdong	0.3169	0.3380	0.3486	0.3564	0.3583	0.3651	0.3736	0.3835	0.3855	0.3872	0.3613
Guangxi	0.1304	0.1451	0.1525	0.1581	0.1625	0.1756	0.1821	0.1886	0.1874	0.1757	0.1658
Hainan	0.1428	0.1587	0.1686	0.1789	0.1851	0.1909	0.1855	0.1856	0.1863	0.1786	0.1761
Mean value	0.2320	0.2590	0.2753	0.2949	0.3035	0.3058	0.3057	0.3154	0.3112	0.3157	0.2919

Data sources: *China Marine Yearbook* (2011–2020), and *China Marine Economic Statistical Bulletin* (2011–2020). (According to Formulas (3)–(5)).

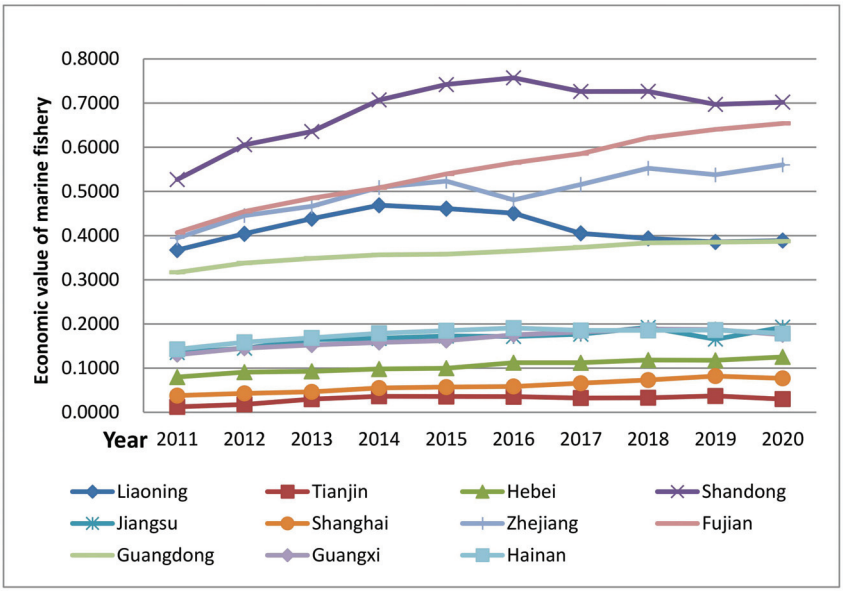

Figure 1. Changes in the economy quality of marine fisheries (2011–2020).

3.1. Spatio-Temporal Evolution of Fishery Economy Quality

In terms of the time trend, from 2011 to 2020, the overall quality of China's fishery economy was generally good, showing a continuous upward trend with an average annual increase of 6%, as shown in Table 3 and Figure 1; however, the development quality of the

marine fishery economy was low, and its resilience was insufficient. As shown in Figure 2, 2016 was an important turning point for the development of the marine fishery economy. In terms of a segmented development, the quality of the marine fishery economies in the coastal provinces/cities showed a linear upward trend, with an increase rate of about 30% from 2011 to 2016. In particular, the growth rate in Liaoning, Shandong, Fujian, and Guangdong was significantly higher than that in other the provinces/cities. In 2016, the quality of the marine fishery economy in Liaoning, Tianjin, Hebei, Shandong, Hainan, and other provinces/cities declined significantly; in particular, the rate of decline in Liaoning reached 12%. The quality of the marine fishery economies in most coastal provinces/cities shows a straight upward trend, with growth rates exceeding 10%.

Regarding the spatial evolution, the marine-fishery-economic quality presents a distribution pattern of a large gap between the north and south and a small gap between areas in the east. In the Northern Marine Economic Circle, the marine-fishery-economic quality of Shandong was far higher than that of the other provinces/cities, with an average of six times and twenty-two times that of Hebei and Tianjin, respectively. This shows that the quality of the marine fishery economy in Shandong had primacy, the quality of the marine fishery economy in the surrounding provinces was low, and clustered development had not yet formed in this region. In the Eastern Marine Economic Circle, Zhejiang had the highest level of marine-fishery-economic quality, with an average of three and nine times that of Jiangsu and Shanghai, respectively. The regional development gap was large. In the Southern Marine Economic Circle, Fujian had the highest level of marine-fishery-economic quality, with an average of three times that of Guangxi and Hainan. There were large gaps in the quality of the marine fishery economies in the region.

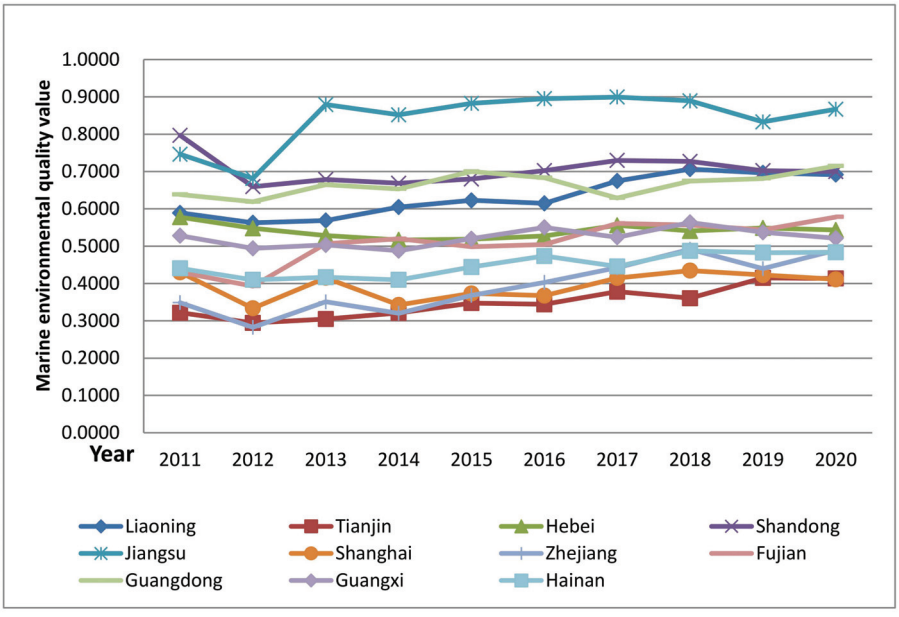

Figure 2. Changes in marine-environment quality (2011–2020).

3.2. Spatio-Temporal Evolution of Marine-Environment Quality

Using the entropy method (Formulas (3)–(5)), we obtained the marine environment–related data of the selected coastal provinces/cities from 2011 to 2020. Table 4 and Figure 2 show the results.

Table 4. Marine-environment quality level in China's coastal provinces/cities (2011–2020).

Province/City	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Mean Value
Liaoning	0.5891	0.5627	0.5686	0.6047	0.6227	0.6146	0.6747	0.7063	0.6964	0.6916	0.6331
Tianjin	0.3216	0.2942	0.3046	0.3211	0.3477	0.3441	0.3780	0.3605	0.4150	0.4133	0.3500
Hebei	0.5776	0.5478	0.5284	0.5167	0.5187	0.5275	0.5559	0.5407	0.5487	0.5433	0.5405
Shandong	0.7969	0.6594	0.6786	0.6687	0.6801	0.7024	0.7297	0.7271	0.7020	0.6999	0.7045
Jiangsu	0.7461	0.6815	0.8794	0.8520	0.8825	0.8951	0.8996	0.8892	0.8329	0.8669	0.8425
Shanghai	0.4299	0.3335	0.4151	0.3424	0.3732	0.3675	0.4147	0.4327	0.4227	0.4112	0.3943
Zhejiang	0.3487	0.2824	0.3509	0.3201	0.3681	0.4030	0.4425	0.4916	0.4397	0.4890	0.3936
Fujian	0.4301	0.3926	0.5066	0.5197	0.4987	0.5045	0.5610	0.5567	0.5439	0.5781	0.5092
Guangdong	0.6382	0.6188	0.6648	0.6533	0.7000	0.6832	0.6292	0.6745	0.6813	0.7147	0.6658
Guangxi	0.5280	0.4941	0.5032	0.4878	0.5199	0.5504	0.5238	0.5634	0.5370	0.5213	0.5229
Hainan	0.4406	0.4097	0.4168	0.4098	0.4441	0.4736	0.4456	0.4872	0.4825	0.4837	0.4494
Mean value	0.5851	0.5309	5805	0.5728	0.5980	0.6073	0.6299	0.6487	0.6362	0.6459	0.6035

Note: The results were calculated using the authors' formula. (According to Formulas (3)–(5)).

Regarding time trends, from 2011 to 2020, the development of the marine-environment quality showed a wave-like upward trend. As shown in Figure 2, the marine-environment quality fluctuated from 2011 to 2013. Since 2014, the marine-environment quality improved at an increasing rate. Although some provinces/cities experienced a temporary decline, they subsequently entered a new, relatively strong growth period. According to the marine environment development index, the marine-environment quality of the coastal provinces/cities is good, with the average marine-environment quality exceeding 0.5 in 10 years. Jiangsu had the best marine-environment quality, with an average of 0.8, while Zhejiang and Fujian had the fastest marine-environment growth, with a rate of more than 30%.

Regarding the spatial dimension, the marine-environment quality presents a spatial distribution pattern of large gaps in the east and small gaps in the north and south. In the Eastern Marine Economic Circle, Jiangsu had the highest marine-environment quality, twice that of Shanghai. The gap is obvious. The marine-environment quality of Shandong in the Northern Marine Economic Circle was the highest and was not much different from that of the other provinces/cities. Guangdong had the best marine-environment quality in the Southern Economic Circle, showing a small gap with the other provinces/cities. At the end of 2020, the average level of marine-environment quality among the regions was very close, all around 0.5. This indicates that regional marine-environment quality in China is gradually changing from an unbalanced state to a more balanced one; however, the differences in the marine-environment quality between provinces are gradually widening. Among them, Liaoning, Shandong, Jiangsu, and Guangdong were in the leading position, being significantly higher than the other provinces/cities, while the averages for Tianjin, Zhejiang, and Shanghai were low.

4. Coordinated Development of Marine-Environment Quality and Marine-Fishery-Economy Quality

Based on the coupling coordination model formula (Formulas (6)–(8)), we calculated the coordination degree between the marine-environment quality and marine fishery economy quality from 2011 to 2020. Table 5 and Figure 3 show the results.

Table 5. Coordination between marine-environment quality and marine-fishery-economy quality (2011–2020).

Province/City	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Mean Value
Liaoning	0.4823	0.4883	0.4997	0.5160	0.5177	0.5130	0.5113	0.5135	0.5091	0.5092	0.5060
Tianjin	0.1778	0.1910	0.2183	0.2325	0.2365	0.2349	0.2355	0.2336	0.2491	0.2357	0.2245
Hebei	0.3278	0.3340	0.3327	0.3354	0.3373	0.3490	0.3534	0.3558	0.3566	0.3613	0.3443
Shandong	0.5693	0.5622	0.5731	0.5864	0.5960	0.6039	0.6033	0.6029	0.5914	0.5920	0.5881
Jiangsu	0.3986	0.3966	0.4361	0.4346	0.4419	0.4427	0.4467	0.4548	0.4310	0.4522	0.4335
Shanghai	0.2527	0.2446	0.2635	0.2622	0.2704	0.2708	0.2877	0.2986	0.3051	0.2982	0.2754
Zhejiang	0.4307	0.4211	0.4497	0.4493	0.4685	0.4691	0.4888	0.5105	0.4931	0.5116	0.4692
Fujian	0.4573	0.4597	0.4978	0.5069	0.5093	0.5167	0.5353	0.5424	0.5433	0.5545	0.5123
Guangdong	0.4742	0.4782	0.4906	0.4912	0.5004	0.4997	0.4923	0.5043	0.5062	0.5128	0.4950
Guangxi	0.3622	0.3659	0.3721	0.3726	0.3812	0.3943	0.3929	0.4037	0.3983	0.3890	0.3832
Hainan	0.3542	0.3570	0.3641	0.3680	0.3786	0.3877	0.3792	0.3878	0.3872	0.3833	0.3747
Mean value	0.3897	0.3908	0.4089	0.4141	0.4216	0.4256	0.4297	0.4371	0.4337	0.4363	0.4188

Note: The results were calculated using the authors' formula. (According to Formulas (6)–(8)).

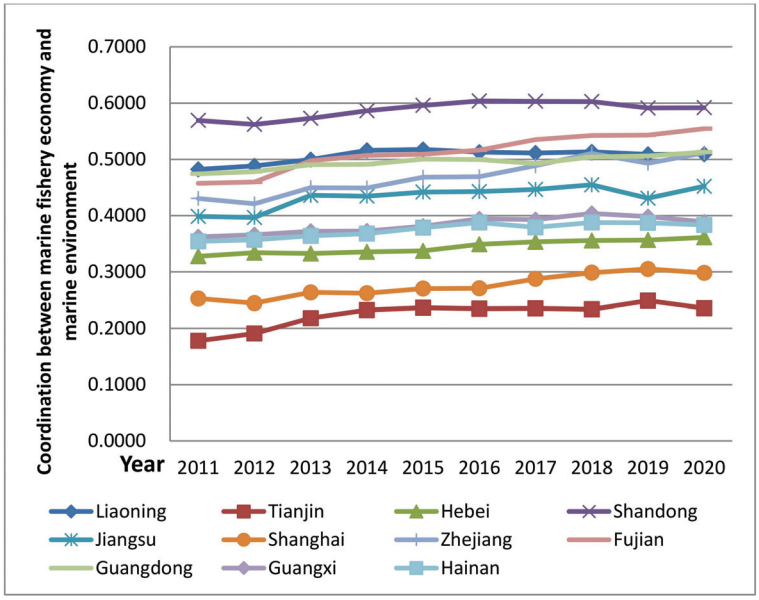

Figure 3. Coordination between the marine-environment quality and marine-fishery-economy quality.

4.1. Temporal Evolution of Coordination between the Marine-Environment Quality and Marine-Fishery-Economy Quality

Figure 3 shows that the coordination between the marine-environment quality and marine-fishery-economy quality rose in waves from 2011 to 2020. This shows that China had attached importance to improving the marine-environment quality and the sustainable development of the fishery economy during the study period. The linkage between the marine fishery economy and the marine environment has now become increasingly obvious, and a new situation of integrated development has taken shape. Fujian and Zhejiang showed the fastest rate of coordinated growth, with an average annual growth rate of about 2%. As shown in Table 5, although the coordination between the marine-environment quality and marine-fishery-economy quality steadily improved during the study period, the overall level was still low, with the average coordination rising from 0.39 to 0.42. The highest coordination value was for Shandong, reaching 0.5920 in 2020, with an average

of only 0.5881. However, the coordination values of Tianjin, Hebei, Shanghai, Guangxi, Hainan, and others were far lower than the average, with an average value of about 0.3, while the average value of coordination in the other provinces was around 0.5. This shows that the coordination between the marine-environment quality and marine-fishery-economy quality was at a low level. The difference was still large from the perspective of an interprovincial coordination value. Shandong had the highest average coordination value, while Tianjin had the lowest, with a difference of more than 2.6 times. This shows that the coordinated development of the marine-environment quality and marine-fishery-economy quality was highly unbalanced.

4.2. Spatial Evolution of Coordination between the Marine-Environment Quality and Marine-Fishery-Economy Quality

To explain the spatial evolution of the coordination between the marine-environment quality and marine-fishery-economy quality, we depict the coordination levels of typical years and map them according to the classification in Table 2. As shown in Figure 4, from 2011 to 2020, the coordination between the marine-environment quality and marine-fishery-economy quality showed a spatial distribution pattern of large differences between the east and north and small differences in the south.

The patterns are summarized as follows:

(1) Serious disorder: In 2011, the coordination between the marine-environment quality and marine-fishery-economy quality in Tianjin was seriously disordered. As shown in Tables 3 and 4, the marine-environment quality and marine-fishery-economy quality in Tianjin were at the lowest level among the selected provinces/cities during the study period and far below the average level. This shows that the development of the marine-environment quality and marine-fishery-economy quality in Tianjin was low.

(2) Mild disorder: Shanghai was in a state of mild disorder in 2011. Tianjin was added in 2014. According to Tables 3 and 4, the level of the marine-environment quality and marine-fishery-economy quality in Shanghai was low, being only slightly higher than that in Tianjin. This shows that the development of the marine environment and the marine fishery economy in Shanghai was relatively slow, the marine-environment carrying capacity was declining, and the resilience of the fishery economy was fragile. In the process of fishery economy development, a coordination between the marine-environment quality and marine-fishery-economy quality had been ignored, hindering the integrated development of the two.

(3) Barely coordinated: In 2011, Hebei, Jiangsu, Guangxi, and Hainan were in a state of being barely coordinated and by 2014, Jiangsu had been removed. By 2020, Guangxi had also been removed. This shows that the coordination between the marine-environment quality and marine-fishery-economy quality in most coastal provinces/cities in China was dynamically adjusting and gradually improving. The development of the marine fishery economy was promoting the gradual improvement of the marine-environment governance capacity and quality. The improvement of the marine-environment quality was also promoting a fishery economy development. However, the coordination between the marine-environment quality and marine-fishery-economy quality in some provinces/cities was still at a low level in terms of their overall coordination.

(4) Primary coordination: In 2011, Liaoning, Shandong, Zhejiang, Fujian, and Guangdong were in a state of primary coordination. By 2014, Jiangsu was added; by 2016, Shandong had been removed. By 2019, Shandong and Guangxi were added, and there were seven provinces in a state of primary coordination. More generally, many provinces/cities had reached the primary coordination state, and these were in a relatively stable state, with small fluctuations and a longer duration. This shows that the primary coordination stage belonged to the stable running period of the marine environment and fishery economy development; however, it was difficult to break through the constraints and enter a new state in the short term.

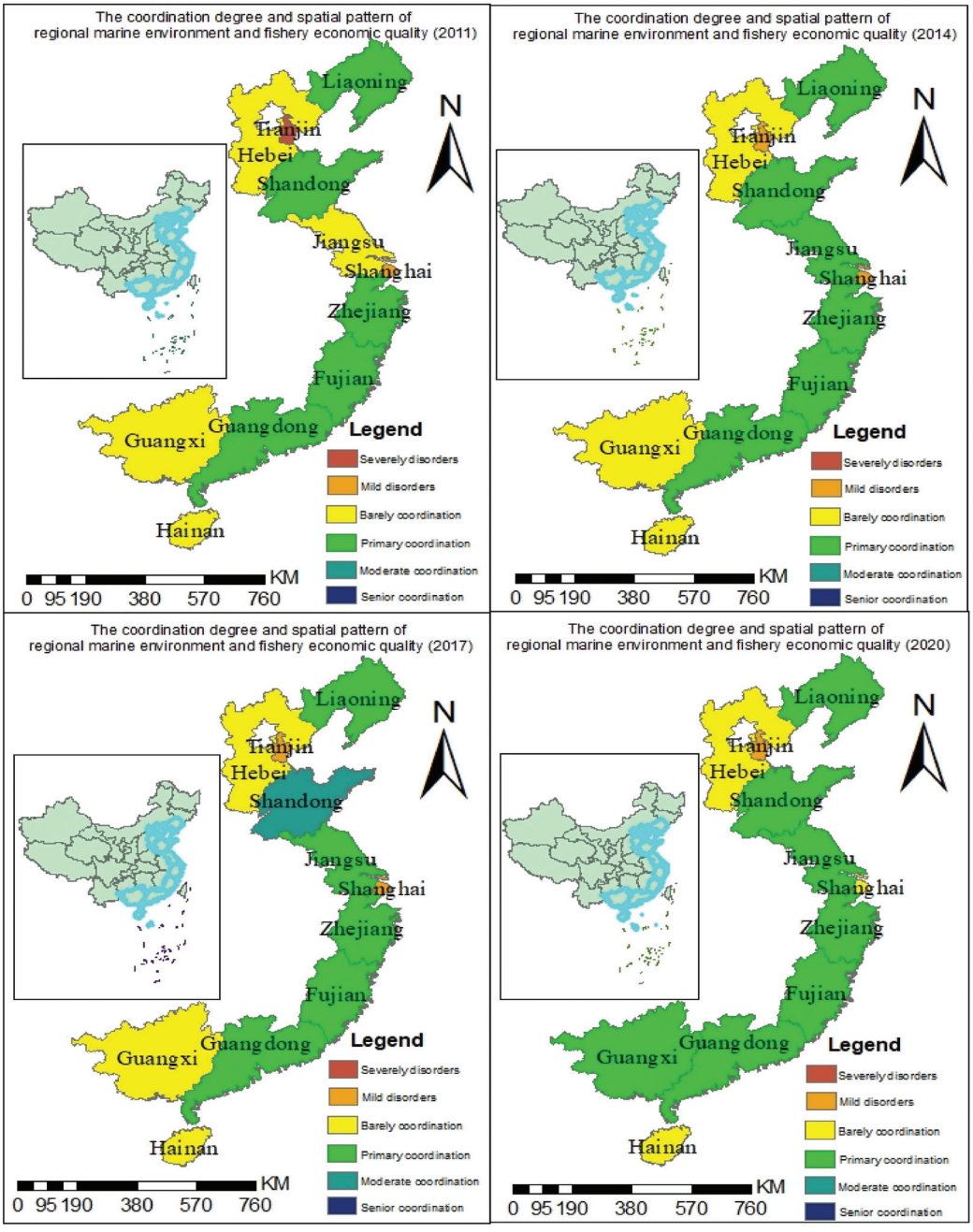

Figure 4. Spatial patterns of coordination between marine-environment quality and marine-fishery-economy quality in typical years.

(5) Moderate coordination: Among the selected provinces/cities, only Shandong was in a moderate coordination state from 2016 to 2018. This shows that Shandong's marine environment and fishery economy had initially formed a benign interactive development

situation. Tables 3 and 4 show that the level of the marine-environment quality and marine-fishery-economy quality in Shandong far exceeded that of the other selected areas during the study period. This is mainly attributable to Shandong taking the lead in transforming and upgrading its fishery industry, cultivating new industries, optimizing the spatial structure of its fisheries, and building a modern fishery industry system. Ideally, China should strengthen its construction of marine ecological civilization, improve its marine-environment protection mechanisms, and promote the coordinated development of the marine environment and the fishery economy. In terms of the overall coordination, Shandong was at the midpoint of an intermediate coordination.

(6) Senior coordination: A coordination between the marine-environment quality and marine-fishery-economy quality had yet to reach the senior coordination state in China. After China's "reform and opening up", its fishery economy entered a period of rapid development, resulting in a depletion of its fishery resources, pollution in the coastal waters, and a sub-healthy or unhealthy marine environment. Based on the concept of green, sustainable development, the traditional fishery industry is undergoing a structural adjustment, optimization, and innovation. Moreover, the restoration and conservation of marine resources have been intensified, helping to improve the marine environment. Furthermore, a coordination between the two is also being accelerated and will eventually reach a state of senior coordination.

5. Factors Affecting Coordination between the Marine-Environment Quality and Marine-Fishery-Economy Quality

5.1. Model Specification

Coordination between the marine-environment quality and marine-fishery-economy quality is affected by many internal and external factors and accurately identifying the various factors is important for improving the coordination between the two. Based on the existing situation in China and the available literature, we selected the marine fishery industry strength (SFI), marine fishery economy scale (SFE), marine fishery production capacity (SFP), marine resource environment quality (SCQ), and marine-environment quality (SBQ) as the main influencing factors. We also took the output value of marine fishery, the output of marine products, the year-end ownership of marine production fishing vessels, the relative annual change in the sea level, and the total amount of phosphorus in directly discharged marine wastewater as the specific indicators. The following random-effect Tobit model was established:

$$Cor = \beta_0 + \beta_1 Ln(SFE) + \beta_2 Ln(SFE) + \beta_3 Ln(SFP) + \beta_4 Ln(SCQ) + \beta_5 Ln(SBQ) + \varepsilon \quad (10)$$

where *Cor* is the dependent variable, which represents the coordination between the marine-environment quality and marine-fishery-economy quality. The value is [0, 1], i = (0, 1, 2, ..., 5) is an undetermined coefficient, and ε is the random error term. In order to explain the results, the percentage of the coefficients and independent variables were logarithmized. In order to evaluate the robustness of the Tobit model, the fixed effect least square method (Model 1), the random effect least square method (Model 2), the mixed model Tobit (Model 3) and the random adaptive model Tobit (Model 4) with the same dependent and independent variables were used for a comparison.

5.2. Descriptive Statistics

As shown in Table 6, the average coordination between the marine-environment quality and marine-fishery-economy quality from 2011 to 2020 was 0.4187. This indicates that the overall coordination between the marine fishery economy and the marine environment was low. The overall standard deviation of all indicators was small, which means that the sample statistics and the overall parameter values were relatively close, and the sample was representative.

Table 6. Descriptive statistics of the variables.

Variable	Symbol	Observations	Mean Value	Standard Deviation	Minimum Value	Maximum Value
Coordination level	Cor	110	0.418749	0.106973	0.177825	0.603891
Strength of fishery industry	SFI	110	4.679636	1.107592	1.850000	6.370000
Scale of the fishery economy	SFE	110	5.003798	1.514934	1.343961	6.652475
Fishery production capacity	SFP	110	3.719994	1.164299	0.826672	5.534104
Quality of marine resource environment	SCQ	110	4.349157	0.399793	3.218876	5.036952
Quality of marine ecological environment	SBQ	110	4.909854	1.139169	1.609438	6.772165

5.3. Empirical Results Analysis

As shown in Table 7, the significance of the estimated values of the SFI, SFE, SFP and C in Model 1 was significantly lower than that in Model 4, and the significance of the estimated values of the SFE, SFP and C in Model 2 was significantly lower than that in Model 4. Meanwhile, the SFI, SFP, SCQ and SBQ in Model 3 passed the significance test, and the estimated values of each independent variable in Model 4 well passed the statistical significance test; therefore, the calculation effect of Model 4 was the best. This shows that the random effect Tobit model is reasonable and feasible. The empirical results of Model 4 show that the strength of marine fishery industry, the scale of the marine fishery economy and the production capacity of marine fishery have a positive effect on the coordination of a marine fishery economy and marine environmental quality. Among them, the influence coefficient of the strength of the marine fishery industry was the highest, reaching 0.041 and passing the 1% significance test, which means that for every 1 percentage point increase, the coordination between the marine-fishery economy and marine-environmental quality would increase by 0.041 percentage points. The impact coefficient of the scale of the marine fishery economy was 0.033, which was the second largest factor affecting the coordination between the marine fishery economy and marine environmental quality, and which also passed the 1% significance test of statistics. This shows that if the scale of the marine fishery economy increased by 1 percentage point, the coordination between the marine fishery economy and marine environmental quality would increase by 0.033 percentage points. The influence coefficient of the marine fishery production capacity reached 0.023, and passed the 5% significance test. This means that the coordination between the marine fishery economy and marine environmental quality would increase by 0.023% for each percentage point increase in the marine fishery production capacity. In general, the strength of the marine fishery industry, the scale of the marine fishery economy and the production capacity of marine fishery are statistically important and highly stable determinants of the coordination between a marine fishery economy and marine environmental quality, and they play an important role in improving the coordination between the two.

Table 7. Model regression results.

Variable	Model 1 Fixed-Effect OLS	Model 2 Random-Effect OLS	Model 3 Hybrid Model Tobit	Model 4 Random-Effect Tobit
SFI	0.0295 ** (0.00768)	0.0329 *** (0.00731)	0.0130 (0.0202)	0.0330 *** (0.00523)
SFE	0.0497 ** (0.0198)	0.0412 ** (0.0144)	0.0806 *** (0.0150)	0.0411 *** (0.00863)
SFP	0.0359 * (0.0178)	0.0240 * (0.0125)	−0.0248 (0.0223)	0.0238 ** (0.0104)
SCQ	−0.0122 *** (0.00183)	−0.0129 *** (0.00189)	−0.0130 (0.0128)	−0.0129 *** (0.00268)
SBQ	−0.0107 *** (0.00172)	−0.0107 *** (0.00190)	−0.0115 (0.00735)	−0.0107 *** (0.00163)
Constant term	0.00410 (0.101)	0.0788 (0.0596)	0.160 ** (0.0604)	0.0788 ** (0.0382)
var(e.y) sigma_u sigma_e			0.000992 ** (0.000248)	0.0402 *** (0.00986) 0.00958 *** (0.000692)
N	110	110	110	110

Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

The impact coefficient of the marine resource environment and marine ecological environment on the coordination of the marine fishery economy and marine environment quality was negative. Therefore, this paper adopted negative indicators for the data of the marine resource environment and marine ecological environment, while they also had a positive effect on the coordination of the marine fishery economy and marine environment quality. Among them, the impact coefficient of marine resources and environment was −0.0129, and this passed the 1% significance test. This shows that if the quality of the marine resources and environment increased by 1 percentage point, the coordination between a marine fishery economy and marine fishery environment quality would increase by a 0.0129 percentage point. The impact coefficient of the marine ecological environment quality was −0.0107, which means that if the marine ecological environment quality increased by 1 percentage point, the coordination between the marine fishery economy and marine environment quality would increase by a 0.0107 percentage point. This shows that the marine resources environment and the marine ecological environment are also statistically important and highly stable determinants of the coordination between a marine fishery economy and the quality of a marine environment. This is consistent with the expectation that improving the quality of the marine environment can increase the coordination between the marine fishery economy and the quality of the marine environment, which fully demonstrates that it is necessary to improve the quality of the marine environment.

6. Countermeasures and Suggestions

Given the current complex, severe situation, to improve the coordination between the marine-environment quality and marine-fishery-economy quality and to promote a coordinated evolution to an advanced stage, we should do the following:

(1) Promote the transformation and upgrading of the marine fishery industry. First, accelerate the innovation of fishery green science and technology, build a fishery green science and technology system, reduce the energy consumption in the marine fishery industry, form an effective linkage with the construction of the marine environment, and achieve the green, sustainable development of the marine fishery economy. Second, promote the digitalization of the marine fishery industry, and build a big data platform for the marine fishery economy. Third, transform the resource-dependent fishery development model, increase investment in marine environmental resource recovery and offshore fishery habitat restoration, and build a new model of marine resource conservation and fishery production

with the coordinated development of fisheries, resources, and ecology. Fourth, promote the integrated development of marine fishery production, marine manufacturing, coastal tourism, and marine environmental protection industries, and cultivate new integrated cross-border businesses, such as marine leisure fisheries, marine biological products, and marine environmental protection.

(2) The scale of the marine fishery economy should be enhanced. First, develop modernized marine fishery and aquaculture. Innovate marine fishery breeding technology, build green marine ranches, promote fishery proliferation and release, promote healthy aquaculture, and improve the scale of marine fishery breeding. Moreover, guide the offshore and deepwater expansion of marine aquaculture and explore large-scale offshore deepwater cages, offshore aquaculture vessels, deepwater bottom seeding, and three-dimensional ecological aquaculture. Second, expand the space for marine fishing. Strengthen the cooperation among countries and regions in deep-sea fishing, and develop new deep-sea fishery resources, while also improving and upgrading deep-sea fishery equipment. Third, improve the quality and scale of marine-fishery-product processing. Innovate the processing of marine fishery products, cultivate new forms of marine fishery processing, and expand the industrial chain of marine fishery processing. Develop the deep processing of ocean aquatic products, innovate product forms, and extend product functions.

(3) Improve the marine-environment quality. First, link the land and sea environmental governance. Improve the overall planning system for the land and marine environments, strengthen the control of land-source pollution, and curb marine pollution from the source. Deepen the marine environmental governance, prioritize ecology, improve the marine-environment quality, and establish an integrated land-and-sea environmental governance system. Second, adhere to joint prevention and control, and utilize high technology to strengthen marine-environment monitoring and supervision. Promote marine-environment restoration and marine environmental protection, and strengthen the supervision and management of the marine environment. Third, improve the marine-environment compensation mechanism. Improve the laws and regulations related to marine-environment compensation; clarify the main body, responsibilities, methods, and standards of marine-environment compensation; and implement protection and compensation for typical ecosystems in important bays. Fourth, implement cross-regional joint ecological defense and governance, and strengthen the regional marine-environment space protection and governance. Strengthen cooperation with neighboring countries in the governance of the marine environment and promote the common governance of the international marine environment.

6.1. Discussion

The United Nations General Assembly pointed out in "Changing Our World: 2030 Agenda for Sustainable Development", that "global warming, sea level rise, ocean acidification and other impacts of climate change have seriously affected coastal areas and low-lying coastal countries, including many least developed countries and small island developing States. The survival of many societies and various biological systems that support the earth is threatened" [37]. The change in marine environments has a significant impact on the marine economy of coastal countries and regions in the world, especially on the development of marine fishery economies. UNESCO pointed out that "At present, the degradation of the marine environment is intensifying, which has a negative impact on the structure and function of the marine ecosystem. By 2050, the global population is expected to reach 9 billion, which will exert greater pressure on the marine ecosystem" [38]. At the same time, the extensive development mode of the marine fishery economy has led to problems such as sea water oxidation, and marine garbage and pollutant concentration, which have caused serious damage to the marine environment and had a huge impact on world food security. How to improve the quality of the marine environment and promote the high-quality development of marine fisheries has become the focus of attention of all countries in the world. Consequently, the quality of the marine environment and marine-fishery-economy development should be improved from a diversified perspective.

Promoting the coordinated development of the marine environment and marine fishery economy is not only a scientific issue, but also a practical issue. Studying the coordination of China's marine environment and marine fishery quality is of great value to other countries and regions in the world, mainly reflected in the following two aspects:

First, studying the coordination of China's marine environment and marine fishery quality provides a new research framework for other countries and regions to improve the quality of their marine environments and marine fishery economies. At present, the research on the economic quality of marine fisheries and the quality of marine environments is as shown in the previous literature review [39], where we have mostly analyzed the economic marine-fishery-quality and the marine-environment-quality as separate entities in a single analysis, or discussed the impact of changes in the marine environment on the development of marine fisheries. We believe that changes in the marine environment can affect the economic development of marine fisheries, and that extensive aquaculture and the overfishing of marine fisheries can lead to the deterioration of the marine environment [40,41]. We seldom discuss the coupling and coordination of the marine-fishery economic quality and marine environmental quality. The marine fishery economic system and the marine environmental system are two closely related systems that interact with each other, and they work together to form a diversified organism; therefore, we need to analyze the coupling and coordination relationship between the two from a systematic perspective to promote their common development and form a positive resultant force. We selected several indicators to construct the indicator system of the marine fishery economic quality and marine environmental quality, we measured their coordination using the coupling coordination model in physics, and selected the Tobit measurement model to measure the important factors affecting their coordination, revealing the coordinated evolution state, laws and regional differences of China's marine fishery economy and marine environmental quality. This was not only conducive to breaking the traditional thinking of separating the marine environment and marine fishery development, giving play to the synergistic effect, but it also helped to provide a new research framework and method for other coastal countries and regions to study their marine fishery economies and marine environment quality.

Second, the study of the coordination of China's marine environment and marine fishery quality provides decision-making reference for other countries and regions to improve the coordination of marine environment and marine fishery quality. We used the model to measure the scale of the marine fishery economy, the strength of the marine fishery industry and the production capacity of marine fishery. These aspects have a far greater impact on the coordination of a marine fishery economy and marine environmental quality than on the marine environmental quality, but this does not mean that the marine environment plays a small role in improving the coordination of a marine fishery economy and marine environment quality. On the contrary, the quality of the marine resources and marine ecological quality had a strong, statistically significant impact on improving the coordination of the marine fishery economy and marine environment quality, which means that to improve the coordination of the marine fishery economy and marine environment quality, we must pay close attention to the level of the marine environment quality. If we want to improve the coordination between the marine fishery economy and marine environment quality, therefore, we should not only promote the high-quality development of the marine fishery economy, but also accelerate the governance and protection of the marine environment. Only by deeply integrating these two aspects can we improve the level of coordination. This is an important reference for other coastal countries and regions in the development of economic and marine environmental policies for marine fisheries.

Of course, we have constructed an evaluation index system for the marine fishery economy and marine environment quality based on the existing research results, which reflects the strength of the marine fishery economy development and the marine environment construction level in a more comprehensive way. However, due to the limitation of the data and materials, some impact indicators have not been included in the evaluation indicator

system, which will inevitably lead to certain limitations in the research, such as changes in the natural environment, labor quality, etc.; consequently, we need to further explore and improve the indicator system. At the same time, we focused on the spatio-temporal evolution characteristics of the coordination between the marine fishery economy and marine environmental quality. The spatial agglomeration analysis of the coordination between the marine fishery economy and marine environmental quality was weak, which will also be the focus of future research. In addition, we considered other work using a qualitative or different statistical method. We note the coupling relationship between the marine fishery economy and marine environmental quality at the global scale and recognize that policies and governance strategies are also valuable.

6.2. Conclusions

By measuring the coordination between the marine-environment quality and marine-fishery-economy quality, we analyzed the pattern of their coordination over time. The following conclusions were obtained.

First, the marine-environment quality and marine-fishery-economy quality are on the rise overall, showing an obvious spatial heterogeneity. In the initial stage, in terms of the quality of the marine fishery economy, during the study period of 10 years, the marine fishery economic quality of Shandong, Zhejiang, and Fujian remained at a high level, with a rapid development rate in a time sequence evolution. In terms of the spatial evolution, the marine fishery economy presented a distribution pattern of a large gap between the south and north and small gaps in the east. The average marine fishery economy of Shandong in the Northern Marine Economic Circle was 22 times that of Tianjin, and the gap was obvious. In the next stage, in terms of the marine-environment quality, during the study period of 10 years, the marine-environment quality of Jiangsu, Shandong, and Guangdong remained at a high level. In terms of the spatial evolution, the marine-environment quality presented a spatial distribution pattern of a large gap in the east and a small gap in the north and south. The marine-environment quality of Jiangsu in the Eastern Marine Economic Circle was twice that of Shanghai. The gap between the provinces in the marine-environment quality gradually widened. By 2020, the marine-environment quality of Jiangsu was 2.5 times that of Tianjin.

Second, the coordination between China's marine fishery economy and the quality of its marine environment shows obvious volatility, but the overall trend is wave like, gradually moving to the intermediate stage. Liaoning, Shandong, Jiangsu, Zhejiang, Fujian, Guangxi and Guangdong had reached the primary level of coordination by 2020. Among them, Shandong and Guangdong were approaching the intermediate level. A coordination between the marine-environment and fishery-economy quality was biased. The marine-environment quality and coordination level were relatively high, but the marine-fishery economic quality was at a low level. Relying on the advantages of the marine-environment quality, this shows a high coordination, forming the negative effect of a high coordination value but a low economic quality. In terms of the spatial evolution, there was a significant difference between the coordinated evolution of the marine-environment quality and the marine-fishery-economy quality, showing a small difference in the south. The difference between the east and north was large. The interprovincial coordination of the marine-environment quality and the marine-fishery-economy quality was in a dynamic adjustment period. Most provinces/cities were in the barely coordinated and primary coordination stages, and only Shandong was in the intermediate coordination stage. Third, the scale of the marine fishery economy and the strength of the marine fishery industry are important factors that affect the coordination between the marine-environment quality and marine-fishery-economy quality. Through a model calculation, we found that the strength of the marine fishery industry, the scale of the marine fishery economy, the production capacity of marine fishery, the marine-environment quality, and the quality of marine resources and the environment had a positive effect on coordination, and that all passed the significance test.

Among them, the impact coefficient of the marine fishery economic scale was the highest, reaching 0.04, followed by that of the strength of the marine fishery industry, reaching 0.03.

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